TRANSITIONS TO SUSTAINABILITY
CONFERENCE HANDBOOK
2010

PROGRAMME AND BOOK OF ABSTRACTS

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Named Events

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The MWH Workshop 3

The Beca Conference Proceedings

4th International Conference on
Sustainability Engineering and Science

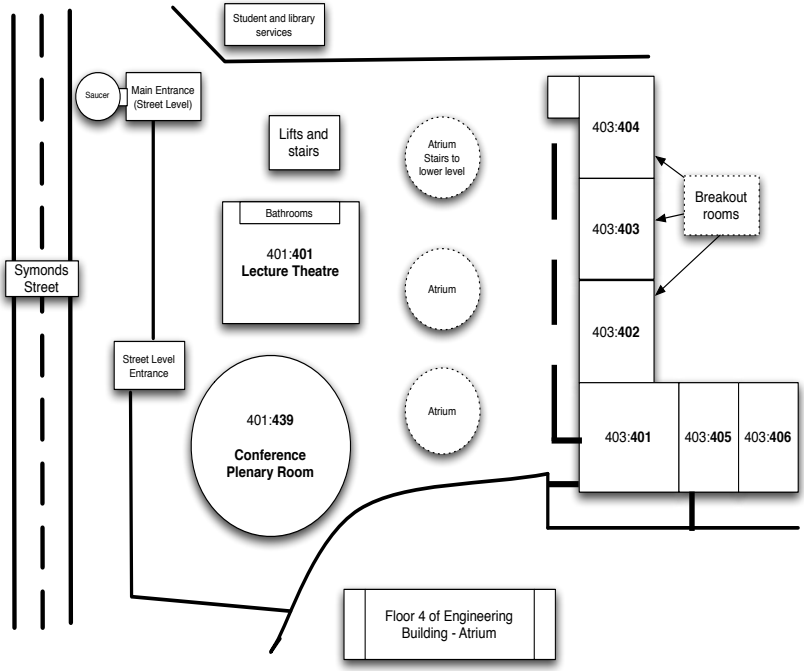
TRANSITIONS TO SUSTAINABILITY CONFERENCE - PROGRAMME OUTLINE	
TUESDAY 30 November 2010, The University of Auckland Business School, Owen G Glen Building - Foyer	
5.00pm	Registrations Open, Music by Scott, The AECOM Official Welcome Reception
6.00pm	Powhiri – Haka the Legend
	Refreshments Served
6.30pm	Welcome: Professor Michael Davies, Dean of Engineering, The University of Auckland
	Guest Speaker: Bob Harvey, Chair of the Auckland Waterfront Development Agency
	Thanked by: James Hughes, AECOM, Music by Scott continues
8.30pm	Function ends
WEDNESDAY 1 December 2010, Faculty of Engineering	
8.00am	Registration Desk Opens - Atrium
8.40am	Plenary Room 401:439, Opening Session
8.45am	Welcome: Dr Carol Boyle, Chair, NZSSES
8.50am	Official Opening: Dr Roger Blakeley, Chief Planning Officer, Auckland Council – Sustainable Cities
9.15am	Principal Keynote: Peter Head OBE FREng FRSA, Director of ARUP, UK *Entering the Ecological Age-The role of science and technology in creating a sustainable economic future for New Zealand*
10.00am	Associate Professor Carol Boyle, International Centre for Sustainability Engineering and Research, ICSER, The University of Auckland – *Critical Risks: Forcing Sustainability*
10.30am	Morning Tea Break
Session 2	**Plenary Room 401:439, Faculty of Engineering**
11.00am	Prof. Martin O'Connor, Université de Versailles St-Quentin-en-Yvelines (UVSQ), Director of international research centre REEDS (Research in Ecological Economics, Eco-innovation and Tool Development for Sustainability) France *Sustaining What, Why, and For Whom? – Tools for grappling with the multiple bottom lines of self-respecting futures*
11.30am	Emeritus Prof. Ian Lowe, Griffiths University, Brisbane – *Values for Sustainable Futures*
12 noon	Dr Darlene Schuster, American Institute of Chemical Engineers Institute for Sustainability *Measuring Sustainability Performance: Benchmarks, Roadmaps, and Certification*
12.30 pm	Lunch Break
1.30pm	**Parallel Paper Session 1**
	Chair: Prof. Hans Schreier, Room 403:401 – *Mixed Session: Beyond Today's Infrastructure/Limits to Growth*
	Chair: Prof. Jorge Vanegas, Room 403:402 – *Limits to Growth (1)*
	Chair: Dr John Peet, Room 403:403 – *Embedding sustainability (1)*
	Chair: Mark Smith, Room 403:404 - *Resilient Societies (1)*
	Chair: Adj.Prof. David Hood, Room 401:401 – *Evolutions to Technology (1)*
3.00PM	Afternoon Tea Break
3.30PM	**Parallel Paper Session 2**
	Chair: Sue-Ellen Fénelon, Room 403:401 – *Beyond Today's Infrastructure (1)*
	Chair: Dr Maggie Lawton, Room 403:402 – *Resilient Societies (2)*
	Chair: Peter Head, Room 403:403 – *Embedding Sustainability (2)*
	Chair: Richard Taylor, Room 403:404 – *Resilient Societies (3)*
	Chair: Yasenko Kirpo, Room 401:401 – *Evolutions to Technology 2*
5.00pm	Plenary discussion, PLENARY ROOM 401:439 – reports from sessions and workshops - Q&A session
5.30pm	Morphum Environmental Cocktail Hour, Atrium, Faculty of Engineering

THURSDAY 2 December 2010, FACULTY OF ENGINEERING	
Session 3	**Plenary Room 401:439**
8.45am	Introductions, Matt Coetzee, Development Manager, Aurecon Group
9.00am	Adjunct Prof. David Hood, Queensland University of Technology *Achieving Sustainability in the Built Environment - Education and Culture Change*
9.30am	Dr Maggie Lawton, Manukau City Council – *Towards 2060; Engaging, Inspiring and Supporting Local Communities*
10.00am	Prof Jorge Vanegas, Texas A&M University, USA – *An Integrated, Transdisciplinary, and Evidence Based Approach for a Sustainability Dividend for the Built Environment*
10.30am	Morning Tea Break
11.00am	**Parallel Paper Session 3**
	Chair: Dr Darlene Schuster, Room 403:301 – *Beyond Today's Infrastructure (2)*
	Chair: Em.Prof. Ian Lowe, Room 403:402 – *Limits to Growth (2)*
	Chair: Prof. Martin O'Connor, Room 403:403 – *New Economics*
	Chair: Prof Hans Schreier, Room 403:404 – *Resilient Societies (4)*
	Chair: Dr John Peet, Room 401:401 – *Mixed theme Session (2) - design*
12.30 pm	**Lunch Break, Workshop Session 1**
1.30pm	Workshop Forum 1, Room 401:439 – *Towards 2060: Design the Future with Dr Maggie Lawton, Simon Harvey, James Samuel and Yasenka Kirpo*
	Workshop Forum 2, Room 401:401 – *Turning Words into Action: Environmental Sustainability and Transportation Network Management, with Jane Puddephat and Mayurie Gunatilaka sponsored by MWH New Zealand*
3.00PM	Afternoon Tea Break
3.30PM	**Workshop Session 2**
	Workshop Forum 3, Room 401:439 – Delivering Sustainable Infrastructure that Supports the Urban Built Environment, Dr Carol Boyle, with Dr Laurence Murphy FRICS and Dr Charlotte Sunde
	Workshop Forum 4, Room 401:401 – *Future of Food: Supply, security and Sustainability*, Dr Ron McDowall with Prof Jacqueline Rowarth, Massey University, and Rob Woodgate CFO PGGWrighton
5.00pm	Plenary discussion, PLENARY ROOM 401:439 reports from sessions and workshops - Q&A
7.00pm	Conference Dinner, Top of the Town - Hyatt Regency Hotel
FRIDAY 3 December 2010, FACULTY OF ENGINEERING	
9.00am	**Parallel Paper Session 4**
	Chair: Caleb Clarke, Room 403:401, *Beyond Today's Infrastructure (3)*
	Chair: Richard Taylor, Room 403:402, *Limits to Growth (3)*
	Chair: Em Prof. Ian Lowe, Room 403:403, *Embedding Sustainability (3)*
	Chair: Sue-Ellen Fénelon, Room 403:404, *Resilient Societies (5)*
	Chair: Mark Smith, Room 401:401, *Resilient Societies (6)*
10.30am	Morning Tea Break
Session 4	**Plenary Room 401:439**
11.00am	Professor Sir Peter Gluckman KNZM FRSNZ FMedSci FRS, Chief Science Advisor to the Prime Minister – *NZ Addressing the perfect storm – the essential role of science*
11.30am	Prof. Hans Schreier, University of British Columbia, Canada, Urban Watershed Management – *How to deal with the Combination of Land Use Intensification and Increased Climatic Variability*
12 noon	Dr John Peet, NZSSES – *Riches or Ruination? Has neoclassical economics reached its use-by date?*
12.30 pm	Lunch Break
1.30pm	Plenary Room 401:439, *Embedding Sustainability*
	Panel discussion with keynote speakers and experts facilitated by Professor Jorge Vanegas, Texas A&M University
3.30-4pm	Closing Session: Dr Carol Boyle

CONFERENCE VENUE ROOM LOCATIONS

Faculty of Engineering
4th Floor Layout

Note: Room numbers starting with 401 are for the large lecture theatres.
Room numbers starting with 403 are the breakout rooms



CONFERENCE DINNER VENUE

Top of the Town, Hyatt Regency Hotel
Cnr or Waterloo Quadrant and Princes Street (see map next page)

Please Note:
You need to confirm your attendance at the Conference Dinner

Please ensure that when you sign in at the Registration Desk that you have your name on the Conference Dinner list,
If you are not on the list you may be refused entry at the venue.

MAP OF UNIVERSITY OF AUCKLAND
and surrounding streets

THE UNIVERSITY OF AUCKLAND
CITY
Te Whare Wānanga o Tāmaki Makaurau

Directory

Accommodation & Conference Services **614**
Accounting & Finance, Dept of **207**
Acoustics Research & Testing Service **422**
Admission & Enrolment **105**
Advancement Office **135**
Alfred Nathan House **103**
Alumni Relations **135**
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New Start **435**
New Zealand Asia Institute **435**
New Zealand Leadership Institute, Excelerator **435**
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Old Choral Hall **104**
Old Government House **102**
O'Rorke Hall **614**
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Polymers & Coatings Science Programme **301**
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Student Administration **105**
Student Commons **315**
Student Financial Support **105**
Student Information Centre **105**
Student Learning Centre **315**
Student Records & Graduation **105**
Student Recruitment & Course Advice **119**
Student Union **311-312**
Students' Association, AUSA **322**
Te Kohanga Reo **255**
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Theology, School of **804**
Thomas Building **110**
Translation Studies, Centre for **206**
Transport **201**
Tuition Fees **105**
Unisafe **201**
UniServices **439**
University Bookshop **315**
University Careers Centre **105**
University Health Services **315**
University House **135**
University of Auckland Developments **207**
University of Auckland Foundation **135**
University of Auckland Society **135**
Vice-Chancellor's Office **103**
Werry Centre **618**
Women's Studies **201**

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i Information Desk
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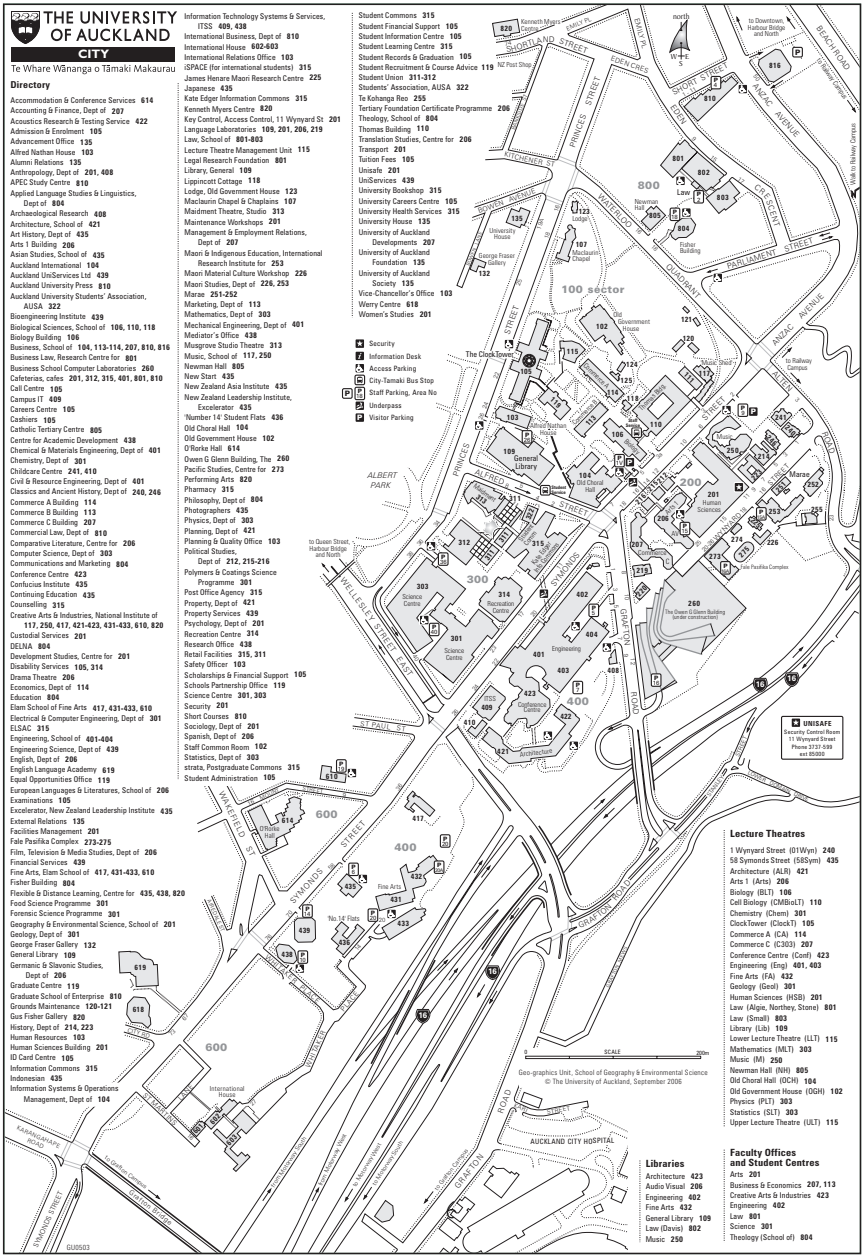
Underpass
P Visitor Parking


north
SHORTLAND STREET
PRINCES STREET
SHORT STREET
BEACH ROAD
ANZAC AVENUE
KITCHENER ST
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ALBERT PARK
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SYMONDS STREET
GRAFTON ROAD
ST PAUL ST
WAKEFIELD ST
KARANGAHAPE ROAD
to Downtown, Harbour Bridge and North
to Railway Campus
to Queen Street, Harbour Bridge and North
to Newmarket, Parnell, Remuera, Eastern Suburbs
to Mt Eden, Epsom, Ponsonby, Western Suburbs
The Clock Tower
Kenneth Myers Centre
NZ Post Shop
Student Union
Alfred Nathan House
General Library
Old Choral Hall
Recreation Centre
Science Centre
Science Centre
Engineering
Conference Centre
Architecture
Fine Arts
No.14 Flats
International House
Human Sciences
Marae
Fale Pasifika Complex
The Owen G Glenn Building (under construction)
Law
Newman Hall
Fisher Building
Lodge
University House
George Fraser Gallery
Maclaurin Chapel
Old Government House
New Zealand Asia Institute
Thomas Building
Arts 1 Building
Commerce A
Commerce B
Commerce C
Old Choral Hall
Owen G Glenn Building
Human Sciences
Marae
Fale Pasifika Complex
Engineering
Science Centre
Science Centre
Conference Centre
Architecture
Fine Arts
No.14 Flats
International House
Wakefield Hall
Symonds Hall
Symonds Flats
Wakefield Flats
Wakefield Apartments
Symonds Apartments
Wakefield Court
Symonds Court
Wakefield Gardens
Symonds Gardens
Wakefield Mews
Symonds Mews
Wakefield Lane
Symonds Lane
Wakefield Terrace
Symonds Terrace
Wakefield Square
Symonds Square
Wakefield Walk
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Wakefield Place
Symonds Place
Wakefield Boulevard
Symonds Boulevard
Wakefield Parade
Symonds Parade
Wakefield Esplanade
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Wakefield Promenade
Symonds Promenade
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Symonds Waterloo
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Symonds Kitchener
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Symonds Princes
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Wakefield Park
Symonds Park
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Symonds Shortland
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Symonds Beach
Wakefield Anzac
Symonds Anzac
Wakefield Parliament
Symonds Parliament

The NZ Society for Sustainability Engineering and Science

The New Zealand Society for Sustainability Engineering and Science (NZSSES) are the hosts of the 4th International Conference on Sustainability Engineering and Science - ***Transitions to Sustainability.***

NZSSES is a Technical Interest Group operating under the auspices of The Institution of Professional Engineers of New Zealand (IPENZ) and is an Affiliate member of the Royal Society of New Zealand.

The 2010 committee are:

Dr Carol Boyle	Chair, The University of Auckland. Email: c.boyle@auckland.ac.nz
Caleb Clarke	Morphum Environmental
Sue-Ellen Fenélon	Morphum Environmental
Yasenko Krpo	CPG New Zealand Ltd
Misty Mossman	Ministry of Agriculture and Forestry
Dr Ir Ron McDowall	The University of Auckland., Management and International Business
Richard Taylor	formerly with Waitakere City Council
Dr John Peet (retired)	Canterbury University - Ex-Officio

Members of the organising committee and NZSSES staff are wearing blue names labels.

Should you require any assistance during the conference, please contact -

- the registration desk
- phone Vicky - 027 2305 365
- or ask someone with a blue name label

The **AGM** and **Member's Christmas Function**
Thursday 16 December
All Welcome.
See Vicky for details about becoming a Member

NZSSES would like to take this opportunity to thank the respective employers of each Committee Member for supporting that member's commitment to the Society and to this conference.

GENERAL INFORMATION

1. The **Conference Proceedings** are provided on the USB stick, sponsored by BECA, included with this Handbook. Printed proceedings are not available.
2. Keynote speakers presentations and speeches (if provided) will be available for downloading from the website post the conference.
3. Parallel Paper Presentations will be available from the website post the conference for downloading.
4. Please note that Security will lock down the presentation rooms at 6pm. Do not leave anything in the rooms for collection later.
5. The **Internet Cafe** requires personal login codes. Please request your code from Vicky at the Reception Desk
6. A **secure lock up** area is available should anyone wish to use it. Contact Vicky
7. **Carparking concessions** are available in the Business School Carpark, Grafton Road. Enter the carpark in the normal way (turn at the lights half way down Grafton Road). Collect your ticket and exchange it with Vicky for a $10 all day pass

DETAILED PROGRAMME

Tuesday - 30 November

	The AECOM Welcome Reception	
5.00pm	Registration Desk opens	Music by Scott
6.00pm	Powhiri	**Haka the Legend**
	Refreshments Served	
6.30pm approx	Welcome	**Professor Jenny Dixon** National Institute of Creative Arts and Industries, University of Auckland
	Guest Speaker	**Bob Harvey** Chair, Auckland Waterfront Development Agency
	Thanked by	**James Hughes,** AECOM
8.30pm	Music by SCOTT continues	Function ends
	The AECOM Welcome Reception	

Wednesday - 1 December

	Wednesday 1 December	
8.00am	Registration Desk opens	
	KEYNOTE PRESENTATIONS	Plenary Room 401:439
8.45am	Welcome	Dr Carol Boyle, Chair NZSSES
8.50am	**Official Opening: Dr Roger Blakeley** Chief Planning Officer, Auckland Council *Sustainable Cities*	
9.15am	**Principal Keynote Address: Peter Head,** OBE, Director and Chairman Planning Consulting, Arup *Entering the Ecological Age-The role of science and technology in creating a sustainable economic future for New Zealand*	
10.00am	**Keynote Address: Associate Professor Carol Boyle** International Centre for Sustainability Engineering and Research, ICSER, University of Auckland *Critical Risks: Forcing Sustainability*	
	10.30 am - 11.00 am Morning Tea Break	

	Wednesday 1 December
11.00am	**Professor Martin O'Connor** Université de Versailles St-Quentin-en-Yvelines (UVSQ) ***Sustaining What, Why, and For Whom? – Tools for grappling with the multiple bottom lines of self-respecting futures***
11.30am	**Emeritus Professor Ian Lowe** Griffiths University, Brisbane ***Values for Sustainable Futures***
12 noon	**Dr Darlene Schuster** American Institute of Chemical Engineers: Institute for Sustainability ***Measuring Sustainability Performance: Benchmarks, Roadmaps, and Certification***
	12.30 - 1.30 pm Lunch Break
1.30pm	**PARALLEL PAPER SESSION 1**
Room 403.401	**MIXED SESSION: Beyond Today's Infrastructure / Limits to Growth** **Chair: Professor Hans Schreier** Dr Hugh Byrd, presented by **Dr Michael Rehm**, University of Auckland *Changing Architecture for a Changing Climate; Unsustainable Trends in New Zealand* **Dr Ian Longley,** NIWA, *What is Sustainable Air Quality?* **Dr John Morrissey,** RMIT University, Melbourne, Australia *Proposal of a tiered conceptual framework for sustainable design and planning of large-scale development projects in the metropolitan context* **Dr John Russell**, La Trobe University, Australia *Transitions to Sustainability - Are we confident about the IPCC climate change predictions for the future?*
Room 403.402	**LIMITS TO GROWTH** **Chair: Professor Jorge Vanegas** **Dr Damien Guirco,** Institute for Sustainable Futures, University of Technology Sydney, Australia *Peak Minerals: mapping sustainability issues at local, national and global scales* **Sungsoo Koh**, ICSER, University of Auckland, *Limits to growth defined by water resource, Waiheke Island case study* **Yasenko and Ana Krpo,** CPG NZ Ltd *Urban Stormwater Runoff quality – lifecycle assessment* **Tara Smith**, Sinclair Knight Merz, Australia. *Shallow Groundwater Resources and Future Climate Change Impacts:A Comparison of the Ovens and Namoi Catchments, Eastern Australia*

	Wednesday 1 December
Room 403.403	**EMBEDDING SUSTAINABILITY** **Chair: Dr John Peet NZSSES** **Shaharudin Idrus,** Institute for Environment and Development (LESTARI). Malaysia *A Malaysian Initiative in Embedding Sustainability: Sustainable School - An Environment Award* Professor Ali Memon, presented by **Nick Kirk,** Lincoln University *Sustainable Governance of Marine Fisheries: A Socio-Ecological Embeddedness Perspective* **Caleb Clarke,** Morphum Environmental Limited *You Can Teach A Young Dog New Tricks: Starting At The Beginning - Sustainable Education* **Dr Stephen Reay,** Auckland University of Technology *How to effectively engage students' with environmentally sustainable product design?*
Room 403:404	**RESILIENT SOCIETIES** **Chair: Mark Smith, NZSSES** **Gayathri Gamage**, ICSER, University of Auckland *An integrated model for assessing sustainability of complex systems using Life Cycle Assessment and Risk* **Ella Susanne Lawton**, Otago Polytechnic Centre for Sustainable Practice, Cromwell *The New Zealand Footprint Project: the Ecological Footprint of Kiwi Lifestyles and Urban Form* **Robert Perry,** presented with **Paul Chambers,** Auckland Council *Carbon Now and Carbon Futures – a systems and performance based approach to reducing GHG Emissions in the Auckland Region*
Room 401:401	**EVOLUTIONS TO TECHNOLOGY** **Chair: Adjunct Professor David Hood** **Fahimeh Foudazi,** Cape Peninsula University of Technology, Sth Africa *Sustainable solutions for Cooling Systems in Residential buildings: Case study in the Western Cape Province, South Africa* Muaviyath Mohamed, presented by **Dr Susan Krumdieck**, University of Canterbury *Sustainable Renewable Electricity for Small Islands : A Methodology for Essential Load Matching* **Ibrahim Mosly,** RMIT, Melbourne, Australia *Study on Risk Management for the Implementation of Energy Efficient & Renewable Technologies in Green Office Buildings* **Assoc. Professor Ahmad Zahedi,** James Cook University, Australia *Sustainable electric energy supply by decentralized alternative energy technologies*
	3.00 - 3.30 pm Afternoon Tea Break

	Wednesday 1 December
3.30pm	**PARALLEL PAPER SESSION 2**
Room 403.401	**BEYOND TODAY'S INFRASTRUCTURE** **Chair: Sue-Ellen Fenélon NZSSES** **Hanani Abd Wahab**, University of Waikato *Solar Roofing System Thermal Performance Analysis* **Taryn McQuinn**, Beca Infrastructure and **Claire Jewell,** NZ Steel *Sustainable Steelmaking: Infrastructure for the Future* **Len McSaveney**, Golden Bay Cement, *Towards More Sustainable Concrete* **Komsun Siripun**, Curtin University of Technology, Perth, Australia *Sustainable Use of Crushed Concrete Waste as A Road Base Material*
Room 403.402	**RESILIENT SOCIETIES Session 2** **Chair: Dr Maggie Lawton** **James Hughes**, Aecom Limited, *Carbon Futures: Reducing Emissions for the Auckland Region* Trivess Moore, presented by **Dr John Morrissey,** RMIT, Melbourne, Australia *Cost benefit pathways to zero emission housing: Implications for household cash-flows in Melbourne* **Phuong Ly,** Queensland University of Technology, Australia *Towards Sustainable Housing for Vietnam* Kay Saville-Smith, presented by **Lois Easton**, Beacon Pathway Limited *Market Transformation to Achieve Large Scale Uptake of Sustainable Residential Renovation in New Zealand*
Room 403.403	**EMBEDDING SUSTAINABILITY Session 2** **Chair: Peter Head OBE** **Dr Patricia Kelly,** Consultant Higher Education, Australia *Embedding Sustainability: painless is just delay* **Assoc. Professor Susan Krumdieck**, University of Canterbury *The Survival Spectrum: the key to Transition Engineering of Complex Systems* **Dr Tim McLernon,** University of Ulster, *Integrating Sustainable Development Into The Higher Education Built Environment Curriculum.* **Asst. Professor Annie Pearce**, Virginia Polytechnic Institute and State University, USA *Strategic Entry Points for Sustainability in University Construction and Engineering Curricula*

	Wednesday 1 December
3.30pm	PARALLEL PAPER SESSION 2….. continued
Room 403.404	**RESILIENT SOCIETIES Session 3** **Chair: Richard Taylor NZSSES** **Laurentiu (Larry) David**, University of Toronto, Canada *On the road to sustainability - the case of the Romanian transportation sector* **Stacy Rendall**, University of Canterbury, *Quantifying Transport Energy Resilience: Active Mode Accessibility* **Aaron Tanner**, Yorkshire Water, UK *Sustainability, information needs and organisational change in UK water and sewerage companies* **Damian Young,** Morphum Environmental Ltd. *Can catchment management can be delivered for the Auckland Super City watersheds and achieve sustainability*
Room 401:401	**EVOLUTIONS TO TECHNOLOGY Session 2** **Chair: Yasenko Krpo NZSSES** **Craig Brown,** Centre for Ergonomics, Occupational Safety and Health (CErgOSH) , Massey University *Achieving Transition: Lessons from Human Factors/Ergonomics* **Tim Martin,** Monash University, Australia *Investigation of the National Pollutant Inventory (NPI) as a Sustainability Tool* **Lenny van Onselen**, Delft University of Technology, The Netherlands *Technology Windows in Sustainable Innovation Projects: Experiences with an Innovation Tool for Identifying Sustainable Application Domains* **Jeff Vickers**, ICSER, University of Auckland *Design for Sustainable Development: A Framework for Sustainable Product Development and its Application to Earthmoving Equipment*
5.00pm	**Final Session - Plenary Discussion** **Plenary Room 401.439**
5.30pm	**Morphum Environmental Cocktail Function**

Thursday - 2 December

	Thursday 2 December
8.45am	KEYNOTE PRESENTATIONS Plenary Room 401:439 MC Day 2 - Matt Coetzee, Development Manager, Aurecon Group
9.00 am	**Adjunct Professor David Hood** Queensland University of Technology, Australia *Achieving Sustainability in the Built Environment - Education and Culture Change*
9.30 am	**Dr Maggie Lawton** Manukau City Council, Auckland, NZ *Towards 2060; Engaging, Inspiring and Supporting Local Communities*
10.00 am	**Professor Jorge Vanegas** Texas A&M University, USA *An Integrated, Transdisciplinary, and Evidence Based Approach for a Sustainability Dividend for the Built Environment*
	10.30 - 11.00 am Morning tea Break
11.00am	PARALLEL PAPER SESSION 3
Room 403.401	BEYOND TODAY'S INFRASTRUCTURE Session 2 Chair: Dr Darlene Schuster **Sakina Mokhtar Azizi,** University of Auckland *Risks Associated with Implementation of Green Buildings* **Joshua Olutayo Olorunkiya**, University of Auckland *Global Thinking- Local Action: Adopting the Low Impact Design (LID) Technologies in Urban Stormwater Management* **Anna Robak**, Opus International Consultants, NZ *Trade-offs between public health and environmental protection in a potable water supply context: Drinking Water Standards New Zealand vs resource consent conditions* **Sarah Sinclair,** Sinclair Knight Merz, NZ *Rethinking sustainable infrastructure using innovation tools*

	Thursday 2 December
Room 403.402	**LIMITS TO GROWTH Session 2** **Chair: Em. Prof. Ian Lowe** Dr Maria Estela Varua, presented by **Anna Evangelista,** University of Western Sydney, Australia *(Un)sustainable Consumption in Australian Households: An Exploratory Study* Michael Dale, presented by **Dr Susan Krumdieck**, University of Canterbury, NZ *Global Energy Modelling - a biophysical approach* **Dr Ian Mason**, University of Canterbury, NZ *Transitioning to a 100% renewable electricity generation system: balancing the roles of wind generation, base-load generation and hydro storage* Samuel Gyamfi, presented by **Dr Susan Krumdieck,** University of Canterbury, NZ *Pattern Recognition Residential Demand Response: An Option for Critical Peak Demand Reduction in New Zealand*
Room 403.403	**NEW ECONOMICS & EMBEDDING SUSTAINABILITY** **Chair: Professor Martin O'Connor** **Dr Robert Howell**. Council for Socially Responsible Investment CSRI, *Transitions to Sustainable Investment* **Jonathan Slason**, Beca, Auckland, NZ *Unintended Consequences of Reduced Consumption* **Dan Ducker**, University of Auckland, NZ *Bridging formal research and informal approaches to enhance civic engagement processes* **Dr Rachel Wolfgramm**, University of Auckland Business School, NZ *Creating leadership in transition to sustainability societies: Reflections from the Universitas 21 Sustainability Project*
Room 403.404	**RESILIENT SOCIETIES Session 4** **Chair: Professor Hans Schreier** **Dr Bruce Hucker**, University of Auckland, *Auckland governance reforms: political legitimacy, democratic accountability and sustainable development.* **Asst. Professor Annie Pearce**, Virginia Polytechnic Institute and State University *Sustainability and Capital Projects: Modeling the Emergent Property of Total Cost of Ownership* Judelyn Salon, presented by **Dr Ermelinda Tobias,** Mindanao State University-Iligan Institute Of Technology. The Philippines *A Correlational Analysis of Collective Social Capital and Sustainable Development Program Outcome in Iligan City, Philippines*

	Thursday 2 December
11.00am	PARALLEL PAPER SESSION 3
Room 401.401	**MIXED THEME Session 2 on design** **Chair: Dr John Peet NZSSES** **Dr Marcel Crul,** Delft University of Technology, The Netherlands *Design for Sustainability: moving from incremental towards radical design approaches* **A.Idil Gaziulusoy,** ICSER, University of Auckland *System Innovation for Sustainability at Produce Development Level: A Scenario Method and a Workshop process* **Dr Stephen Reay,** Auckland University of Technology *Design for Biodiversity: a new approach for ecologically sustainable product design?*
	12.30 - 1.30 pm Lunch Break
1.30 pm	WORKSHOPS Session 1
Room 401.439	**Towards 2060: Design the Future:** with Dr Maggie Lawton, Simon Harvey, James Samuel & Yasenko Krpo
Room 401.401	**Turning Words into Action: Environmental Sustainability and Transportation Network Management** With Jane Puddephatt and Mayurie Gunatilaka, MWH NZ Ltd. **Sponsored by MWH New Zealand**
	3.00 - 3.30 pm Afternoon Tea Break
3.30pm	WORKSHOPS Session 2
Room 401.439	**Delivering Sustainable Infrastructure that Supports the Urban Built Environment** with Dr Carol Boyle Presentation of Paper developed through the Blueprints for Sustainability Conference 2008. And Dr Laurence Murphy FRICS and Dr Charlotte Sunde making a presentation on **Transforming Auckland: Institutional, Technological and Cultural Innovations for Sustainable Cities.**
Room 401.401	**Future of Food: Supply, Security and Sustainability** with Dr Ron McDowall, University of Auckland; Prof Jacqueline Rowarth, Massey University, and Rob Woodgate CFO PGGWrighton
5.00pm	**Final Session - Plenary Discussion** **Plenary Room 401.439**

	Thursday 2 December
	Hyatt Regency Top of the Town
7.00pm	**Conference Dinner** - Pre-dinner drinks **Hyatt Regency Top of the Town** Cnr Waterloo Quadrant and Princes Street 7.30pm Seated for dinner **Music by: Scott**

Friday - 3 December

	Friday 3 December
9.00am	PARALLEL PAPER SESSION 4
Room 403:401	BEYOND TODAY'S INFRASTRUCTURE Session 3 **Chair: Caleb Clarke NZSSES** **Vince Dravitzki,** Opus Central Laboratories NZ *Pathways to a more sustainable transport infrastructure* **Dr Jan Havenga**, University of Stellenbosch, South Africa *Revitalisation of short railway lines in South Africa: A long term view for sustainability* Assoc. Professor Susan Krumdieck, presented by **Stacy Rendall,** University of Canterbury *TACA Sim: a survey for adaptability assessment* **Professor Arthur Williamson**, University of Canterbury *Transitions in transit: future options for transport energy in New Zealand*
Room 403:402	LIMITS TO GROWTH Session 3 **Chair: Richard Taylor NZSSES** **Assoc. Professor Ahmad Fariz Mohamed**, Institute for Environment and Development (LESTARI), Malaysia *From the Linear to Cyclic Approach for Sustainable Waste Management in Malaysian City* **Dr Gavin Mudd**, Monash University, Australia *The "Limits to Growth" and 'Finite' Mineral Resources: Re-visiting the Assumptions and Drinking From That Half-Capacity Glass* **Joshua Olutayo Olorunkiya**, University of Auckland *Risk as a Fundamental Barrier to Adoption of Low Impact Design Technologies* **Zhehan Weng**, Monash University, Australia *Projecting the Full Pollutant Cycle from Coal Utilisation to 2050: Understanding the Global Environmental Implications*

	Friday 3 December
9.00am	PARALLEL PAPER SESSION 4 - continued
Room 403:403	EMBEDDING SUSTAINABILITY Session 3 Chair: Em.Prof Ian Lowe **Lois Easton**, Beacon Pathway Limited, NZ *The Eco Design Advisor Programme: Supporting the Transformation of New Zealand's Housing* Francis Harrison, presented by **Dr Maggie Lawton**, of the former Waitakere City Council, Auckland, NZ *Community Advocacy for Sustainable Living* **Paul Quinlivan**, Sinclair Knight Merz, Auckland, NZ *Embedding Sustainability into School Curriculums* **Eion Scott,** Auckland Council *Resilience in sustainability*
Room 403:404	RESILIENT SOCIETIES Session 5 Chair: Sue-Ellen Fénelon NZSSES **Asst. Professor Annie Pearce,** Virginia Polytechnic Institute and State University, USA *Costing Sustainable Capital Projects: The Human Factor* **Jesús Rosales Carreón** University of Groningen, The Netherlands. *Sustainability: Seeing Through The Eyes Of Farmers* **Bridget Rule**, ICSER, University of Auckland *Challenges for sustainable infrastructure development in small island developing states* **Assoc. Professor Osamu Saito**, Waseda University, Japan *Measuring lifecycle carbon footprint of a golf course and greening in the golf industry*
Room 401:401	RESILIENT SOCIETIES Session 6 Chair: Mark Smith NZSSES **Shaharudin Idrus**, Institute for Environment and Development (LESTARI), Malaysia *Non-linearity of Urban Expansion: Transition to Sustainability* **Colin O'Byrne**, Victoria University of Wellington, NZ *Urban Form as a Reflection of Governance Practices* **Matthew Paetz,** Aecom, *Sustainable Suburbia – Oxymoron or Realistic Goal?* **Dr Felicity Powell**, Opus Central Laboratories *The renaissance of inner city living and its implications for infrastructure and services: A Wellington case study*

	Friday 3 December
	10.30 - 11.00 am Morning tea Break
11.00am	KEYNOTE PRESENTATIONS Plenary Room 401:439
11.00am	Prof Sir Peter Gluckman KNZM FRSNZ FMedSci FRS Chief Science Advisor to the Prime Minister *Addressing the perfect storm – the essential role of science*
11.30am	Professor Hans Schreier University of British Columbia, Canada *Urban Watershed Management: How to deal with the Combination of Land Use Intensification and Increased Climatic Variability*
12.00 noon	Dr John Peet NZSSES *Riches or Ruination? Has neoclassical economics reached its use-by date?*
	12.30 - 1.30pm Lunch Break
1.30pm	PANEL DISCUSSION - Embedding Sustainability Facilitated by Professor Jorge Vanegas A panel of experts will discuss effective methods of Embedding Sustainability
3.30pm	CLOSING SESSION - Dr Carol Boyle

KEYNOTE SPEAKERS

SPEECH ABSTRACTS and PROFILES

In order of programme

Bob Harvey

Chair of the Auckland Waterfront Development Agency

The transformation of Waitakere from sub- to super City

In 1992 Mayor Harvey was elected as Mayor of Waitakere on the platform of an Eco City. Few even understood the term but they voted for Harvey in overwhelming numbers to give the West a new identity. Over 18 years Harvey was elected six times - a record number for any Mayor in any major city. Working with both new and experienced Councillors Harvey brought a new sense to local government leadership. His Eco City philosophy as well as "first call for children" became a guiding philosophy.

Bringing together Maori, Pacific and new migrants and seeking new and innovative designs and creativity, Waitakere City took off and became a catch word in New Zealand for sustainability and environment. The Waitakere Way continued to grow and was matched by five magnificent libraries, the building of the largest stadium in New Zealand, designer bridges across streams and the massive stream cleaning and replanting project Twin Streams.

As the new super city emerged, Harvey sought to lift the Eco City and sustainability onto the incoming Mayoral candidates. He succeeded brilliantly when his close colleague and advocate, Penny Hulse, became the Deputy Mayor. Together they will present how the Eco City and the West's philosophy could serve the greater region.

A fascinating look into a transformed, vibrant green community.

Contact Bob at moviemanbob@hotmail.com

Dr Roger Blakeley

Chief Planning Officer, Auckland Council

Sustainable Cities

Abstract:

Exactly 1 month after the inauguration of the new Auckland Council, and one of the largest organisational transformations in New Zealand's history, this address will discuss some of the major challenges and opportunities for the new Auckland Council.

One of the global megatrends is that "cities will drive economic growth". Globalisation and the knowledge economy have repositioned cities as the drivers of national economies. By 2025, 75% of the world's population will live in cities or metropolitan areas. Cities are responsible for 75% of the world's energy use and produce more than 80% of all greenhouse gas emissions, mostly carbon dioxide.

We are already working on the spatial plan for Auckland. The European Union, Spatial Planning Charter says that "Regional/Spatial planning gives geographical expression to the economic, social, cultural and ecological policies of society". The principles are the same as those of sustainability.

Some of the challenges are to establish Auckland as a world class city that is known for:

1. A strongly growing economy, capitalising on high value, knowledge intensive, high technology industries.
2. Transforming to a low carbon economy by shifting towards renewable energy usage and radically improving energy efficiency.
3. Quality urban design that creates distinctive spaces with a strong identity and sense of place.
4. A healthy environment that sustains people and nature.
5. An inclusive city that offers opportunities to all citizens.
6. A city known for its cultural vitality.

It is no surprise that the engineering and science professions hold the key to unlock the opportunities for sustainable cities through sustainable technologies in energy, transport, buildings, land management, water, waste management and by capitalising on industry sectors where Auckland has competitive strength: high value logistics, clean technology, business and professional services, "neutraceuticals" and value added food and beverage exports, electronics, machinery, marine, ICT, health and education.

Profile:
Roger Blakeley is the Chief Planning Officer of the new Auckland Council. Dr Blakeley's principal tasks for Auckland Council will involve the development of a Regional Spatial Plan for Auckland, which sets out the long term vision and framework for development over the next 30 years. This will include a picture of future development and growth including "greenfields" development, urban intensification, rural residential, industrial and business growth, waterfront master plan, transport and other infrastructure, landscape and environmental protection and heritage management. It also involves the development and integration with the Regional Policy Statement, District Plan, Long Term Plan, Local Board Plans and Regional Land Transport Plan.

Dr Blakeley brings a wealth of experience to this role. As Secretary for the Environment, he was involved in conceiving and developing the Resource Management Act 1991, and while Chief Executive at the Department of Internal Affairs initiated work on the Local Government Act 2002, in particular its vision and strategic framework with the focus on community well-being. Immediately before taking up this position, he was Chief Executive of Porirua City Council.

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Peter Head OBE, FREng FRSA

Director and Chairman Planning Consulting ARUP, UK

Entering the Ecological Age-The role of science and technology in creating a sustainable economic future for New Zealand

Abstract:

This presentation will summarise Peter's ground breaking Brunel Lecture for the Institution of Civil Engineers, which summarises research into the policies and practices needed to enable 9 billion people to live sustainably on the planet in 2050.He will describe the global feedback from his 30 country tour that is relevant to New Zealand and focus in on the possible directions that policy and practice could take, with particular emphasis on the science and technology developments that New Zealand is well placed to implement and export to support the radical global paradigm shift that is needed.

Profile:

Peter is a champion for developing global practice that demonstrates that the way we invest public and private money in the built environment could be made very much more effective if the public and private sector adopted sustainable development principles. He is a civil and structural engineer who has become a recognised world leader in major bridges, advanced composite technology and now in sustainable development in cities. Peter was awarded an OBE for successfully delivering the Second Severn Crossing as Government Agent.

He joined Arup in 2004 to create and lead their planning and integrated urbanism team which has now doubled in size. He was appointed in 2002 by the Mayor of London as an independent Commissioner on the London Sustainable Development Commission and led the planning and development sub-group of the Commission.

Peter has won many awards for his work including the Award of Merit of IABSE, the Royal Academy of Engineering's Silver Medal and the Prince Philip Award for Polymers in the Service of Mankind. He is a judge for the Prince Philip Designers' Prize , the Holcim Awards and the Earth Awards, and is an expert adviser to the Singapore Government on Green Buildings and Infrastructure and he is on the advisory panel for the World Future Council. In July 2008 he was awarded an honorary doctorate in engineering at Bristol University, where he is a visiting Professor in Systems Engineering. In 2009 he was awarded the Sir Frank Whittle medal of the Royal Academy of Engineering for a lifetime contribution to the well-being of the Nation through environmental innovation. Also in 2008, he was cited by Time magazine as one of 30 global eco-heroes and has been one of CNN's Principle Voices.

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Assoc. Professor Carol Boyle

Director, International Centre for Sustainability Engineering and Research (ICSER), University of Auckland

Critical Risks: Forcing Sustainability

Abstract:

Some of the timeframes for critical global risk events are starting to become clearer for the next thirty to fifty years. These are risk events which will either force or precipitate major changes in current ways of life and include potential disruptions to energy, food, water and metal resource supplies, as well as the global climate. Such disruptions will have different effects locally, regionally and on different levels of society and may require different solutions. Mechanisms to reduce the risks are hampered by the reliance of government and the economy on established and locked in economic frameworks which encourage consumption and use of fossil fuels. While engineers typically rely on technology for solutions, it is widely acknowledged that we are going to need innovative solutions to meet the challenges. Moreover, a systems-based approach will be needed to address the complexity inherit within urban areas, which may require entirely new paradigms which challenge our current priorities. However, it is questionable if we have time to develop innovative technologies and systems in time to meet the challenges which these risk events will pose and societal reliance on the current economic paradigm may delay any governmental implementation of effective solutions. This presentation will provide an overview of the risks society will face over the next fifty years and identify potential directions for society to transition to sustainability.

Profile:

Carol is Chair of NZSSES, Director of the International Centre for Sustainability Engineering and Research (ICSER) at the University of Auckland and Associate Professor in the Department of Civil and Environmental Engineering at the University of Auckland. She has been working in the field of sustainability engineering for the past 13 years, both as a researcher and a lecturer. Her main research focus is on understanding and applying the science and engineering needed to achieve sustainability. Dr. Boyle's other research focuses on developing sustainable infrastructure and sustainable communities. She has been a member of the Engineering Practice Board of IPENZ since 2006 and is working with IPENZ on a review of the Sustainability Action Plan for IPENZ. She received a Fellowship from IPENZ in 2009 for her research and work on sustainability engineering.

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Professor Martin O'Connor

Université de Versailles St-Quentin-en-Yvelines (UVSQ), France.
Director of REEDS (International Centre for Research in Ecological Economics, Eco-innovation and Tool Development for Sustainability)

Sustaining What, Why, and For Whom? – Tools for grappling with the multiple bottom lines of self-respecting futures

Abstract:
Sustainability is the (unresolved) challenge of seeking the coexistence of multiple values and forms of community, that are far from naturally reconciled. Present-day comforts and future generations' opportunities? Indigenous biodiversity, cultural diversity, market competitivity and election majority? This talk will highlight sustainability at national, international and local scales, as a problem of principled navigation within dilemmas. It will review the hopes, sometimes forlorn, of the New Zealand RMA as a deliberative forum for articulating and governing within dilemmas of social choice. It will discuss recent (and not so recent) efforts to define and measure multiple bottom-line indicators of performance at macro-economic level (so as to get 'beyond GDP'). And, to finish, it will present some operational evaluation techniques to empower stakeholders in negotiation of 'common' futures that are respectful of multiple values and multiple bottom lines.

Profile:
Martin O'Connor is Professor in Economic Science at the Université de Versailles St-Quentin-en-Yvelines (UVSQ) in France. He is university-trained in physics and in social sciences and is a leader in inter-disciplinary research on the interface between society and environment. After more than 10 years of teaching and applied social science research in New Zealand (PhD studies at Auckland University 1984-1990 and, Lecturer in Economics 1990-1995), he has worked at the UVSQ since 1995.

His teaching specialities are economics of the environment; sustainability theory and policy; microeconomics; decision support systems, risks and governance. His research activities, mostly in French and European institutional contexts, span the fields of ecological economics, evaluation, green national accounting, sustainability studies, integrated environmental analysis, energy analysis and water resources governance fields. He is currently Director of the international research centre REEDS (Research in Ecological Economics, Eco-innovation and Tool Development for Sustainability), created in 2009 as an evolution of the former C3ED (Centre for Economics and Ethics of Environment and Development) operating from 1995-2009 at the UVSQ.

He has led European research projects in integrated assessment, energy-economy-environment modelling and scenario studies, social science methodology for environmental valuation, indicators for sustainable development, and the development of interactive multimedia tools for knowledge partnerships deliberation about sustainability and territorial governance problems (Deliberation Matrix and KerBabel™ Indicator Kiosk). With Professor Sylvie Faucheux at the UVSQ, he co-pilots the International Journal of Sustainable Development (IJSD, an interdisciplinary scientific journal published by Inderscience since 1997) and is a prime mover in several inter-university cooperation programmes for post-graduate education in Ecological Economics and Sustainable Development including on-line distance delivery options in English and in French for Masters-level curriculum.

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Emeritus Professor Ian Lowe

Griffith University, Brisbane

Values for Sustainable Futures

Abstract:

The way we are living is not sustainable. It is depleting resources future generations will need, seriously damaging natural systems and promoting social instability by widening the gap between rich and poor. Organisations as conservative as the World Economic Forum and the International Energy Agency have concluded that sustainable futures need to be radically different, calling for a "reboot" of the economic system and "an energy revolution" respectively. Change on this scale needs more than just new technologies to provide energy, food, water, shelter and transport. It also demands a fundamental transition in community values, from the "cowboy economy" to a space-ship society. We only have a fighting chance of meeting the challenges we face if we tackle them in an integrated way, recognising that we are now a global community and accepting the need to think on a time-scale of centuries rather than years. As Raskin argues, the old values of individualism, consumerism and domination of nature need to be replaced by identification with the global family, emphasis on the quality of life and ecological sensitivity, recognising that natural systems have critical thresholds which we must not exceed. So there is no future in clinging to the myth of unlimited growth. This transition to new values is a much greater challenge to our social structures, political institutions and economic systems than renewable energy, electric vehicles, drip irrigation or organic farming. Technological innovation alone will not save us from a very bleak future. The new values represent the only hope for civilisation.

Profile:

Ian Lowe is Emeritus Professor of Science, Technology and Society at Griffith University in Brisbane and Adjunct Professor at Sunshine Coast and Flinders Universities. In 2002, Prof. Lowe was awarded a Centenary Medal for contributions to environmental science and won the Eureka Prize for promotion of science. His contributions have also been recognised by the Australian Prime Minister's Environment Award for Outstanding Individual Achievement, the Queensland Premier's Millennium Award for Excellence in Science, the University of New South Wales Alumni Award for achievement in science and the Konrad Lorenz Gold Medal, awarded by the International Academy of Sciences. Professor Lowe is a Fellow of the Australian Academy of Technological Sciences and Engineering and was named Australian Humanist of the Year in 1988.

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Dr Darlene Schuster

American Institute of Chemical Engineers: Institute for Sustainability

Measuring Sustainability Performance: Benchmarks, Roadmaps, and Certification

Abstract:
Sustainability can be approached and measured from many levels—corporate, process, product and individual professionals. An overview will be presented of various ways to benchmark and measure sustainability at these levels and major initiatives of the AIChE Institute for Sustainability will be highlighted. The AIChE Sustainability Index(sm) and the Center for Sustainable Technology Practices Sustainability Framework, and efforts to develop a certification program for individual practitioners of sustainability will be reviewed. The roles of benchmarking sustainability performance and the utility of such benchmarks for the chemical industry as they approach greening along their supply chains will also be discussed

Profile:
Darlene Schuster presently serves as the Executive Director of the Institute for Sustainability, an AIChE Technological Community, where she oversees the industry, membership and youth-focused entities formed to advance the science and state of sustainability and the creation of the AIChE Sustainability Index(sm) a benchmark for industry. Previously she was a Science Policy Fellow for the American Chemical Society, where she worked to educate congressional staff and Congress on technical policy issues. Dr. Schuster was awarded the 2004 Technical Achievement Award from the Central Pennsylvania Engineers Council in part for contributions to novel technology product development and commercialization by her company, DP Group, Inc. Previously, Dr. Schuster was the Clare Boothe Luce Chair of Chemical Engineering at Bucknell University, and held various engineering positions with Gulf Oil Production Research, which subsequently became Chevron Oil Field Research Company. Dr. Schuster holds a BSChE (WVU), MSChE (University of Pittsburgh),and Ph.D. (West Virginia University).

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Adjunct Professor David Hood

Queensland University of Technology

Achieving Sustainability in the Built Environment - Education and Culture Change

Abstract:

Achieving sustainability outcomes in the built environment requires far more than guidelines and "star" rating schemes. If building and infrastructure practitioners are not equipped with the knowledge and competencies to ensure that the design, construction and operation of our built environment actually achieves positive improvements in natural, social and economic capital, then all we will be doing is continuing to degrade environmental and societal wellness by just minimising impacts in the name of higher economic returns. Is it enough to simply deliver one subject on sustainability in the first year of an undergraduate program, and expect students to apply that knowledge across the remainder of their course? Are the competency standards we set for practitioners sufficient to ensure that sustainability is a consideration in design and management of our projects and businesses? David will address these issues with examples from his experience, and case studies of sustainability in action.

Profile:

David is a civil and environmental engineer with vast experience across major civil and military projects, professional development in emerging economies, senior management in both the public and private sectors and in education. Following a successful career in project management David took over and commissioned Australia's then new Parliament House in the mid 1980s - a life changing career episode. Since that project, David has become increasingly involved in fostering a culture of sustainability across all engineering disciplines and the built environment. David is Chairman of the Australia Green Infrastructure Council, Immediate Past Chairman of Australia's College of Environmental Engineers, and was a Founding Director and Deputy President of the Australian Sustainable Built Environment Council (ASBEC) from 2004 until December 2008

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Dr Maggie Lawton

Manukau City Council

Towards 2060; Engaging, Inspiring and Supporting Local Communities

Abstract:

Manukau has a history of working innovatively to support the quality of life of its communities and to address social issues. Towards 2060 continues in that vein by departing from the general form of consultation to have deep engagement with its community on subjects that matter. The dialogue focused on how to enhance community social and physical infrastructure by upholding principles of sustainability and through an enhanced awareness of their current and preferred future state, become more resilient and mutually supportive, reducing negative social problems in the process. Could communities in fact "design their future" and how then could local government and other agencies assist them in that goal?

Towards 2060 community engagement built on the work carried out in the Auckland Region to develop the Auckland Sustainability Framework in 2007. The information base to inform the discussions was developed through published, commissioned and in-house research and made available through a website www.towards2060.org.nz Inclusive facilitation techniques, games and videos were used to inform and inspire people to then consider the longer-term development of their communities through visioning, backcasting and action planning, based on the approaches and tools developed by the Natural Step. Despite the serious nature of some of the discussions, consideration of population pressures and resource limitations, the creative format for the discussions through workshops over a two day period, kept the conversations optimistic and energetic.

The workshops were held across the communities of Manukau, as well as in a number of secondary schools. The workshops captured the aspirations of those present and that information has been made available through formal and informal channels to the Auckland Council.

New planning approaches, including spatial planning, require an enhanced approach to working with the community towards deriving a shared vision and goals. Much has been learnt from the Towards 2060 community engagement project which can inform and enhance that aim.

Profile:

Maggie Lawton's education and qualifications include a BSc in biochemistry and a PhD in chemistry along with more recent specialist papers related to sustainable development. She was a member of the Executive Team at Landcare Research and was involved in a wide range of research and policy issues including climate change, land use and land use change, catchment management, urban development and housing; in fact almost all aspects of sustainable development. After leaving Landcare Research, Dr. Lawton developed a research and consulting business from 2006 to 2008. She then joined Manukau City Council in the position of Manager, Strategy and Policy. Since 1 November she is leading the development of water management strategy and policy for the Auckland Council and providing policy advice to the Mayor's Office. Dr. Lawton believes that New Zealand's natural resource base means that it should be well placed to show global leadership in sustainable development through the actions of local communities and organisations and their encouragement of political support. Her vision is for New Zealand to prosper through sustainable development.

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Professor Jorge Vanegas

Texas A&M University, USA

An Integrated, Transdisciplinary, and Evidence Based Approach for a Sustainability Dividend for the Built Environment

Abstract:

21st century challenges for urbanism, civil infrastructure systems, and facilities, cannot afford to continue following the same approaches that have been used to date in their development. Rather, they require new approaches that are bold, innovative, systems based, and contextually sensitive; from their planning, financing, development, and delivery, to their use, operation, maintenance, and end of service life. Within these approaches, governments, together with stakeholders in the public and private sectors, must work collaboratively at local, national, regional, and even international levels, to pursue strategies, mechanisms, and processes that will lead to a Sustainable Built Environment: All stakeholders, from government officials, policy makers, regulatory agencies, finance institutions, community leaders, through planners, architects, engineers, suppliers, builders, to end-users, must link, coordinate, and integrate their efforts as a single cohesive critical mass, pooling, leveraging, and sharing their resources, within public/private partnerships at any level, from local to international, in the pursuit of sustainable urbanism, sustainable civil infrastructure systems, and sustainable facilities. Overall, the goal is a high Sustainability Dividend.

This presentation will discuss three emerging trends toward the achievement of a high Sustainability Dividend for the Built Environment The first trend focuses on three levels of Integration:

(1) Integrated Project Delivery (IPD);
(2) Integrated Design Process (IDP); and
(3) Building Information Modeling (BIM) and Interoperability within the total life cycle of projects.

The second trend focuses on transcending individual disciplines with the goal of a Transdisciplinary understanding of the built environment, through an imperative of unity of knowledge, and a concurrent concern with what is between disciplines, across different disciplines, and beyond all disciplines. Finally, the third trend focuses on Evidence Based practice, which is based on a questioning approach to practice that leads to scientific experimentation, meticulous observation, documentation, and analysis (as opposed to anecdotal case description), and cataloguing and archiving the evidence for dissemination and systematic retrieval.

Profile:

Dr Jorge Vanegas is currently the Dean of the College of Architecture at Texas A&M University. He also serves as Director of the Center for Housing and Urban Development (CHUD), and holds the Sandy and Bryan Mitchell Master Builder Endowed Chair. He is an expert in built environment sustainability and advanced project delivery strategies. A registered architect in Colombia, Dr. Vanegas holds a degree in architecture from Universidad de los Andes in Bogotá, as well as Master of Science and Doctorate degrees in construction engineering and management from the Department of Civil and Environmental Engineering at Stanford University. His primary areas of expertise include, among others, built environment sustainability; advanced strategies, tools, and methods for integrated capital asset delivery; and creativity, innovation, design, and entrepreneurship for the architecture, engineering and construction industry. He has an extensive portfolio of accomplishments in learning/teaching, research/creative work, and engagement through practice, outreach, and service. For his work in these areas in over two decades, Dr. Vanegas academic and professional honors include being elected member of the Pan American Academy of Engineering in 2010; receiving the 2010 Achievement Award of the Engineering and Construction Contracting Association, the 2007 FIATECH STAR Award for Superior Technical Achievements, the Society of Hispanic Professional Engineers 2001 Educator of the Year Award, and the 1995 Outstanding Instructor Award from the Construction Industry Institute; and being the recipient of a National Science Foundation National Young Investigator Award in 1992. Before coming to Texas A&M, Vanegas held academic appointments at the Georgia Institute of Technology and at Purdue University.

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Professor Sir Peter Gluckman KNZM FRSNZ FMedSci FRS

Chief Science Advisor to the Prime Minister

Addressing the perfect storm – the essential role of science

Abstract:

Sustainability can be considered at multiple levels. At the planetary level there is increasing concern about the conflation of water security, food security and energy security against the backdrop of a global population increase to at least 9 billion by 2050, climate change and rising incidences of non-communicable disease. In turn each of these issues is reflected at the regional level and indeed many solutions, either mitigatory or adaptionary, will have to be regional and local in nature. There are inevitable tensions that will emerge and already inhibit finding solutions. These tensions may be geopolitical in nature, (eg the North-South divide over greenhouse gas emissions), ideological in nature (eg the US political debate over climate change), philosophical (eg the tension that could emerge between the desire to sustainability and green ideals and the need to produce foods in threatened environments that may require GMOs), or economic. These may occur at global, regional or local levels and generate the real risk of inadequate responses. Science is essential to addressing these components of the "perfect storm". Yet the type of science needed involved often involves complex non linear systems such as climate and food security models. In such models predictions may have high levels of uncertainty making the science easier to reject or ignore. It also invites exaggerated claims. We do not live in Platonic society and conveying an understanding to the public is complex. The issue of public engagement and understanding is already a real challenge and will grow. Technological choices will have to be made to address these multiple issues and conveying an understanding of the inevitable balance of risks and benefit to any action will also challenge the scientific and political leadership. However the counterfactual of an inadequate scientific and technological effort is obvious.

Profile:

Sir Peter Gluckman is Professor of Paediatric and Perinatal Biology at the University of Auckland and the the first Chief Science Advisor to the New Zealand Prime Minister. Sir Peter is past Director of the National Research Centre for Growth and Development at the University of Auckland. He was formerly Head of the Department of Paediatrics and Dean of the Faculty of Medical and Health Sciences and was founding Director of the Liggins Institute. In 2007 he was appointed Programme Director for Growth,

Development and Metabolism at the Singapore Institute for Clinical Sciences. He also holds honorary chairs at National University of Singapore and the University of Southampton. Sir Peter is the only New Zealander elected to the Institute of Medicine of the United States National Academies of Science and a Fellow of Academy of Medical Sciences of Great Britain. He is a Fellow of the Royal Society of London, an honour bestowed on just 37 New Zealand-born scientists since the Society's establishment in 1660. In 2001 he received New Zealand's top science award, the Rutherford Medal. In 2004 he was New Zealand Herald New Zealander of the Year and in 2006 won the KEA/NZTE World Class New Zealander Award. In 2007 he was made a DCNZM (later ressigned to Knight Companion in 2009) for services to medicine having previously been made a CNZM in 1997.

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Professor Hans Schreier

Faculty of Land & Food Systems, University of British Columbia, Canada

Urban Watershed Management: How to deal with land use intensification and increased climatic variability.

Abstract:
The combination of land use intensification and climate change is emerging as a key issue for urban water managers. Recent evidence suggests that climate variability is increasing, leading to more intense storms, higher peakflows, lower base flows and a major shift in the timing of the freshet. At the same time densification is leading to increases in impervious surfaces, which results in faster runoff, increased flooding and more extensive pollution loadings into urban streams. Rapid urban growth is also putting pressure on drinking water supplies with emerging water shortages during dry periods and increased contamination during storm events. Innovative adaptation strategies need to consider new ways of water conservation, source water protection, and rainfall management to minimizing runoff. Urban soil and landscape management is proving to be an effective tool to reduce outdoor water use during dry periods, absorbing and detaining runoff water during storm events, and reducing the pollution load. Several case studies will be presented from Canada to show the effectiveness of urban adaptation methods for source water protection, water conservation and stormwater management. The successful implementation of a climate change adaptation strategies has now been completed in five communities in British Columbia and the risk assessment methodology and examples of innovative actions to reduce the risk can now be shared with a wide range of communities.

Profile:
Hans Schreier is a professor in the Faculty of Land & Food Systems at the University of British Columbia. His research focuses on watershed management, land-water interactions, soil and water pollution and GIS. He has worked extensively in watershed studies in the Himalayan and Andean regions, and in Brazil, Honduras, Vietnam, Mongolia, as well as in British Columbia. In 1996 he was recognized by the International Development Research Centre (IDRC) for his contribution to improve water resources management in the developing world.

In 1999 he received the Manaaki Whenua Fellowship Award by Landcare Research in New Zealand. He completed the Himalayan-Andean Watershed Project, which resulted in the production of 9 multi-media CD-ROMs that highlighted and compared watershed projects in Bolivia, Peru, Ecuador,

Bhutan, Nepal, and China. In 2000 he developed a WEB-based Certificate Program in Watershed Management that consists of 5 courses that can be taken by graduate students and professionals from around the world by distance. So far over 1000 individuals from 24 different countries have participated in the program. From 2003-2007 he was Co-Leader of the Watershed Program of the Canadian Water Network National Centre of Excellence and he is a member of the Water Advisory Panel for the Columbia Basin Trust.

In 2004 he received the "Science in Action" Award from The United Nations International Year of Fresh Water, Science & Education Program, for outstanding work in making watershed management knowledge and innovative, cost-effective applications possible in Canada and in Developing Countries. In 2008 he received the King Albert International Mountain Award for scientific accomplishment of lasing values to the world's mountains. King Albert I Memorial Foundation, Zurich, Switzerland..

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Dr John Peet

NZ Society for Sustainability Engineering and Science

Riches or Ruination? Has neoclassical economics reached its use-by date?

Abstract:

Unless we decide very soon to make far-reaching changes in the way we in NZ and the World plan for the future, the destructive forces of modern economics promise to cause enormous damage to our ecosystems, our social systems and even our economies themselves. The changes that are needed will require substantially-different ethics to be used as the basis for development of policy at all levels of society. The ethics needed – and the axioms that arise from them that will be the core of the new economics - will be informed by the best of modern complex systems physical, ecological and social sciences.

This presentation enlarges upon a major study carried out during 2008-9 by Sustainable Aotearoa NZ and the NZ National Commission for Unesco, as NZ's contribution to the United Nations Decade of Education for Sustainable Development. The author was a member of the team that carried out the study.

Profile:

John Peet was born in the UK but has been living in Christchurch, New Zealand for the last 49 years. John has a BSc in Chemical Technology, a PhD in Chemical Engineering and has worked in the petroleum industry. He is a Retired Senior Lecturer in Chemical and Process Engineering at the University of Canterbury, where his main focus over the last two decades was sustainable development. John is the author of Energy and the Ecological Economics of Sustainability and papers on systems, sustainability and the ethical requirements of stakeholder involvement. Since retiring from the University of Canterbury, John has worked closely with a number of local, national and international non-government organisations on issues of sustainable development.

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WORKSHOPS

Abstracts and speaker profiles

WORKSHOP 1

Towards 2060: Design the Future

Thursday 1.30pm

With
Dr Maggie Lawton, Simon Harvey, James Samuel and Yasenko Krpo

Abstract:
This workshop will follow the approach used in the community engagement programme carried out by Manukau City Council across Manukau City this year. Those workshops were designed to inform, engage and entertain to develop an agreed long-term plan for a sustainable, preferred, possible and plausible future.

Much thought went into how to best engage with the communities so that our workshops were a huge step beyond the usual consultative process required under legislation.

The workshops were based on the premise that people need to have access to the same information as their government agencies so that they can make fully informed decisions. They should have information on global drivers of change so that they can draw their own conclusions on some of the challenges and opportunities the future will bring. They should be able to contribute to a community voice which is built into the planning framework which will define their communities and City.

One objective of the project was to add to the body of knowledge around community engagement because ultimately we all need to be part of the change that sustainable development. There is no pretension that we got it all right but we think we made progress and are keen for others to build on that.

This workshop will take participants through many of the approaches we used with community groups. It is an opportunity to see the facilitation techniques, view the information base, experience the games and hold the type of conversations that we enjoyed with people of all ages and walks of life in Manukau. We welcome this opportunity to engage with you.

Profiles:

Simon Harvey

Simon Harvey is a senior advisor for The Natural Step NZ and currently serves as its Executive Director. Having practised as a barrister for 10 years, Simon re-focused his career and began advising businesses and local government on sustainability in 2006. He has worked with a number of city, district and regional councils, as well as a broad range of large corporate and smaller SME businesses. Simon enables organisations to see – and plan towards – a future of sustainable value creation, whilst navigating through the fast changing regulatory and market conditions of today. Simon helps his clients make sense of sustainability and implement a well thought-out, strategic response. He has recently been part of the Towards 2060 team.

James Samuel

James Samuel is best known for his support of the emerging Transition Towns movement in New Zealand. During that time this self-organising grass roots initiative has grown to over 50 Transition Towns initiatives. Towns and suburbs all over New Zealand are taking practical steps to increase local resilience, and drastically reduce carbon emissions. They are finding Transition Towns to be a source of inspiration and practical ideas for engaging their community. James is often called on to speak and facilitate groups involved in "conversations that matter". He has most recently been involved in the Towards 2060 programme in Manukau City.

Yasenko Krpo

Yasenko Krpo of CPG NZ Ltd has over 25 years experience working in Bosnia and Herzegovina, the UK and New Zealand for both public and private sectors focusing on customers, quality and delivery. Yasenko's ongoing focus and commitment is in consulting with businesses with an emphasis on sustainability and environmental solutions and directing complex and multidisciplinary projects. His expertise includes: infrastructure asset management for roads, waters and parks; infrastructure and utility design and project management; quality management for water resource management; organisational change and development; urban development planning and design; infrastructure funding schemes; business management; risk management project planning and execution; geo spatial technologies and strategic management.

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Yasenko Krpo <Yasenko.Krpo@nz.cpg-global.com>

WORKSHOP 2 *sponsored by MWH New Zealand*

Turning Words into Action: Environmental Sustainability and Transportation Network Management

Thursday 1.30pm

With
Jane Puddephatt
Team Leader Planning and Environmental Services, and
Mayurie Gunatilaka
NZ Business Development and Strategy Manager Planning and Environmental Services

Abstract:
Infrastructure owners are increasingly seeking improved environmental outcomes. Transport infrastructure delivery teams are faced with the significant challenge of translating this expectation into operational reality. MWH has combined national expertise in transportation network delivery and environmental management to develop a unique environmental performance improvement framework. The framework delivers actions for improved environmental management outcomes from operational activities. This workshop will explore the challenges of "turning words into action" and generate ideas on how to make it a reality.

Profiles:
Jane and Mayurie are both from MWH's Planning and Environmental Services Team. Jane currently leads the Planning and Environmental Services Team in Auckland and has a background in environmental management and sustainable practice. Jane has worked with transportation clients on a range of environmental projects from basic compliance through to strategic planning and contract specification.

Mayurie is currently the Business Development and Strategy Manager for MWH's National Planning and Environmental Services Team. Mayurie is an Environmental Scientist by training and has worked with transportation network operations for the past five years. Her focus has been to provide practical advice that will assist network managers in delivering their work programmes.

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WORKSHOP 3

Delivering Sustainable Infrastructure that Supports the Urban Built Environment

Thursday 3.30pm

Dr Carol Boyle

This workshop will begin with a presentation on the paper developed as an outcome of the *Blueprints for Sustainability Conference* in 2008 and published in ES&T Journal. An international workshop of twenty eight people met post the conference to identify key issues, including:

- *Improving Understanding of Sustainability*
- *The impact of Global Warming*
- *Increased Urbanization*
- *Increasing Age and Risk of Failure in Urban Infrastructure.*
- *Increase in Consumption in Developing Countries*
- *Resource Availability: Energy, Water, and Construction Materials.*

Dr Boyle will explain and expand on these discussions.

The second part of the workshop will include a presentation by **Professor Laurence Murphy** and **Dr Charlotte Šunde** on The University of Auckland's recently established cross-faculty thematic research initiative, **Transforming Auckland: Institutional, Technological and Cultural Innovations for Sustainable Cities.**

Auckland already enjoys an international reputation for being one of the most liveable cities in the Pacific Rim region. The challenge now and for the foreseeable future, is to transform Auckland into one of the world's most sustainable cities. Climate, career and business prospects, and a desirable quality of life have attracted to Auckland the largest concentration of population in the country. But along with increasing population comes increasing pressure on infrastructure, transport, housing, energy resources and governance. These issues reflect in microcosm pressing concerns that impact the entire planet – climate change, poverty, biodiversity loss, peak oil, population growth, and global financial instability.

Transforming Auckland: Institutional, Technological and Cultural Innovations for Sustainable Cities presents a unique opportunity for The University of Auckland to take a lead role, nationally and locally, in urban sustainability research and delivery. Within an international research context, *Transforming Auckland* will focus on innovations for sustainable cities, using Auckland as a

model or exemplar. *Transforming Auckland* will contribute to international and national literatures on sustainability, while providing practical interventions and leading-edge research that informs local and central government agencies and supports community-led sustainability initiatives in Auckland. Three broad research themes, set out in the *Transforming Auckland* Development Plan (2010), include:

1. Understanding and managing change for urban environments;
2. Transformations in space and place for sustainable futures; and
3. Imagining and developing mechanisms/interventions for sustainability.

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WORKSHOP 4

Future of Food: Supply, Security and Sustainability
Thursday 3.30pm

With
Dr Ron McDowall, University of Auckland,
Professor Jacqueline Rowarth, Massey University, and
Rob Woodgate, CFO, PGGWrighton

Abstract:
The United Nations Food and Agriculture Organisation (UNFAO) has indicated recently that world food production needs to double by the year 2030. This has significant supply, security and sustainability issues for New Zealand. If we (and the world) are to double food production, it is clear it must be done sustainably. This workshop will canvas the issues of the future of food and sustainability for New Zealand.

Profiles:

Ron McDowall

Ron is a Senior Lecturer in the Faculty of Business and Economics at the University of Auckland, a Management Consultant on Science and Engineering, a UN Mission Specialist Scientist/Engineer in Hazardous and Toxic Chemical Waste, a Chartered Professional Engineer (CPEng), a Fellow of the Institution of Professional Engineers New Zealand (F.IPENZ), a Fellow of the New Zealand Institute of Management (F.NZIM) and a professional member of the Royal Society of NZ. He holds a conjoint BBS/BSc in physics, business management and marketing from Massey University, a PhD in Economics from the Graduate School of Management at Waikato University, and has approximately 40 years experience as a professional engineer. His awards include IPENZ Supreme Technical Award (The Furkert Award) for Sustainability, the Green Dove Award from SGS International (Geneva), and a Teacher of the Year Award (Students) for Environmental Engineering at the University of Auckland in 2003. He lectures in the MBA programme in sustainability, complexity and decision. His international work with UNEP is highly regarded and he is considered a world expert in hazardous and toxic waste cleanup.

Jacqueline Rowarth

Jacqueline is Director of Agriculture at Massey University. Prior to this she worked with AgResearch for six years and then taught plant science at Lincoln University for six years. She is an active scientist, with a strong

commitment to promoting awareness of science and the importance of research to schools, interest groups and society in general. Professor Rowarth obtained an agricultural science degree with first class honours in agronomy and a PhD in soil science from Massey University. She received the Zonta Award for excellence in science in 1994, a New Zealand Science and Technology Medal in 1997 and in 2001 was elected as a Companion of the Royal Society of NZ. In 2003, she was elected as an Honorary Fellow of the New Zealand Institute of Agricultural Science. Her Majesty, the Queen, recognised Jacqueline's contribution to agriculture in 2008 by awarding her the New Zealand Order of Merit. In 2009 she was recognised as the Federated Farmers Agricultural Personality of the Year and in 2010 she received the Agricultural Communicator and Journalist Guild Award for Communicator of the Year.

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Rob Woodgate

Rob is Chief Financial Officer for PGG Wrightson and is responsible for the company's Finance and Accounting functions along with Risk Assurance and Treasury. He joined the company in 2009 as Group Financial Controller and worked closely with the senior management team through the capital raise and business strategy. He has held a number of senior finance roles in New Zealand and the UK.

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PANEL DISCUSSION on Embedding Sustainability

Friday 1.30pm

Facilitated by Professor Jorge Vanegas

Sustainable outcomes will be achieved more quickly once society sees the dangers in our current development paradigms, grasps the need for change, and realises the benefits from the adoption of new behaviours.

How will we make sustainability a part of our daily lives? How will we educate society, our politicians, business leaders, and our practitioners to meet this challenge of embedding sustainability in common practice? It requires leadership from all professions to vision, to create a future that replenishes lost natural and social capital while ensuring the long term wellbeing of life on the planet.

Professor Jorge Vanegas will lead a panel of experts in a discussion on what can be done to speed up the changes that are needed in our societal constructs (economic, education and infrastructure systems) to better engage and motivate society towards sustainability.

SCHOOL OF ARCHITECTURE

STUDENTS' POSTER DISPLAY

De-carbonising Auckland's CBD

How can cities survive with less water, less food and less energy?This question is being asked across the globe and major cities are setting up programmes for decarbonising themselves. Interestingly, it is architects who are being asked to lead this work.

MArch (prof) students at the University of Auckland's School of Architecture and Planning have taken up this challenge and come up with some innovative ways of decarbonising Auckland's CBD. Urban food production, cycle superhighways, ecological corridors, resilient buildings and water catchment are a few of the ideas that could transform the city as we enter the post-carbon era.

With advice and guidance from many groups and organisations, the students have graphically illustrated the potential of Auckland to reduce its ecological footprint and move towards greater resilience in the future.

We would like to acknowledge the support of:
The New Zealand Society for Sustainable Engineering and Science, Auckland City Council Eco Advisor, The University of Auckland's Energy Centre and Property Departments, Morphum Environmental Ltd, Auckland Council Urban Design, Southern Perspectives Ltd, Waitakere City Council Eco Advisor and The Ministry of Green.

BOOK OF ABSTRACTS

Index listed in alphabetical order of lead author, followed by co-authors
As received

	Author name	Title	First name	Co-authors	Organisation	Country
1	**Abd Wahab**		Hanani[1,3]	Dr Mike Duke[1]; Dr TimAnderson[2]; Dr James Carson;	University of Waikato, Deakin University, Australia[2]; Universiti Tun Hussein Onn Malaysia[3]	NZ
2	**Brown**		Craig	Professor Stephen Legg	Centre for Ergonomics, Occupational Safety and Health (CErgOSH) , Massey University	NZ
3	**Byrd**	Dr	Hugh	Dr Michael Rehm	University of Auckland	NZ
4	**Clarke**		Caleb	Lucy Preston; David Phillips; L.Fourie	Unitec / Morphum / Epsom Normal	NZ
5	**Crul**	Dr	Marcel	Ir., Jan Carel Diehl,	Delft University of Technology	The Netherlands
6	**Dale**		Michael	Dr Susan Krumdieck; Prof Pat Bodger;	University of Canterbury	NZ
7	**David**		Laurentiu (Larry)	Dr Frantz Daniel Fistung	Economics Center of Industry and Services–Romanian Academy, Bucharest; Ontario Institute for Studies in Education–University of Toronto	Canada
8	**Dravitzki**		Vince	Tiffany Lester; Peter Cenek,	Opus Central Laboratories	NZ
9	**Ducker**		Dan	Dr Kepa Morgan	University of Auckland	NZ
10	**Easton**		Lois	Roman Jacques	Beacon Pathway Limited	NZ
11	**Foudazi**	Mrs	Fahimeh	Dr Mugendi M'Rithaa	Cape Peninsula University of Technology	South Africa
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15	**Gyamfi**		Samuel	Dr Susan Krumdieck; Dr Larry Brackney	University of Canterbury	NZ
16	**Harrison**		Frances		Waitakere City Council	NZ
17	**Havenga**	Dr	Jan	Zane Simpson	University of Stellenbosch	South Africa
18	**Howell**	Dr	Robert		Council for Socially Responsible Investment CSRI	NZ
19	**Hucker**	Dr	Bruce		University of Auckland	NZ

TITLE	Theme	Presenter	Day	Session	Room
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Achieving Transition: Lessons from Human Factors/Ergonomics	Evolutions in Technology	Craig Brown	Wed 3.30 pm	2	401:401
Changing Architecture for a Changing Climate; Unsustainable Trends in New Zealand	Mixed Session 1 BTI/Limits	Michael Rehm	Wed 1.30pm	1	403:401
You Can Teach A Young Dog New Tricks: Starting At The Beginning - Sustainable Education	Embedding sustainability	Caleb Clarke	Wed 1.30pm	1	403:403
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20	**Hughes**		James	Steve Goldthorpe, Robert Perry	AECOM	NZ
21	**Idrus**		Shaharudin	Abdul Samad Hadi, Ahmad Fariz Mohamed, Siti Nashroh Shaari and Mazlin B Mokhtar	Institute for Environment and Development (LESTARI)	Malaysia
22	**Idrus**		Shaharudin	Abdul Samad Hadi; Abdul Hadi Harman Shah; Ahmad Fariz Mohamed	Institute for Environment and Development (LESTARI)	Malaysia
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25	**Krpo**		Ana	Yasenko Krpo, CPG NZ, Tony Miguel, Waitakere City Council, Helen Chin, Waitakere City Council	Auckland Council	NZ
26	**Krumdieck**	Assoc. Prof	Susan		University of Canterbury	NZ
27	**Krumdieck**	Assoc. Prof	Susan	Montira Watcharasukarn, Shannon Page	University of Canterbury	NZ
28	**Lawton**		Ella Susanne[1]	Professor Robert Vale[2,] Prof. Brenda Vale[2,] Dr Maggie Lawton[3]	[1]Victoria University of Wellington, [2]Otago Polytechnic Centre for Sustainable Practice, [3]Manukau City Council	NZ
29	**Longley**	Dr	Ian	Gustavo Olivares, Dr Guy Coulson	NIWA	NZ
30	**Ly**		Phuong	Professor Janis Birkeland, Associate Professor Nur Demirbilek	Queensland University of Technology	Australia
31	**Martin**		Tim	Dr Gavin Mudd	Monash University	Australia
32	**Mason**	Dr	Ian	Dr Shannon Page; Professor Arthur Williamson	University of Canterbury	NZ
33	**McLernon**	Dr	Tim		University of Ulster	UK
34	**McQuinn**		Taryn	Claire Jewell	Beca Infrastructure Limited & New Zealand Steel Limited	NZ
35	**McSaveney**		Len		Golden Bay Cement	NZ
36	**Memon**	Professor	Ali	Nick Kirk	Lincoln University	NZ
37	**Mohamed, F**	Assoc. Prof	Ahmad Fariz	Prof. Abdul Samad Hadi; Shaharudin Idrus; Assoc. Prof. Abdul Hadi Harman Shah	Institute for Environment and Development (LESTARI),	Malaysia

Carbon Futures: Reducing Emissions for the Auckland Region	Resilient Societies	James Hughes and Robert Perry	Wed 3.30 pm	2	403:402
A Malaysian Initiative in Embedding Sustainability: Sustainable School - An Environment Award	Embedding sustainability	Shaharudin Idrus	Wed 1.30pm	1	403:403
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Integrating Sustainable Development Into The Higher Education Built Environment Curriculum.	Embedding sustainability	Tim McLernon	Wed 1.30pm	2	403:403
Sustainable Steelmaking: Infrastructure for the Future	Beyond today's infrastructure	Taryn McQuinn and Claire Jewell	Wed 3.30 pm	2	403:401
Towards More Sustainable Concrete	Beyond today's infrastructure	Len McSaveney	Wed 3.30 pm	2	403:401
Sustainable Governance of Marine Fisheries: A Socio-Ecological Embeddedness Perspective	Embedding sustainability	Nick Kirk	Wed 1.30pm	1	403:403
From the Linear to Cyclic Approach for Sustainable Waste Management in Malaysian City	Limits to Growth	Fariz Mohamed	Fri 9am	4	403:402

38	**Mohamed, M**	Mr	Muaviyath	Dr Susan Krumdieck; Dr Larry Brackney	University of Canterbury	NZ
39	**Mokhtar Azizi**	Ms	Sakina	Dr Elizabeth Fassman; Assoc.Prof. Suzanne Wilkinson	University of Auckland	NZ
40	**Moore**	Mr	Trivess	Dr John Morrissey	RMIT University	Australia
41	**Morrissey**	Dr	John	Dr Usha Iver-Raniga; Patricia McLaughlin; Assoc.Prof. Anthony Mills	RMIT University, Melbourne	Australia
42	**Mosly**		Ibrahim	Dr Guomin (Kevin) Zhang	RMIT University	Australia
43	**Mudd**	Dr	Gavin		Monash University	Australia
44	**O'Byrne**		Colin	Assoc. Prof Penny Allan	Victoria University of Wellington	NZ
45	**Olorunkiya**		Joshua Olutayo	Dr Elizabeth Fassman, Assoc.Prof. Suzanne Wilkinson	University of Auckland	NZ
46	**Olorunkiya**		Joshua Olutayo	Dr Elizabeth Fassman, Assoc.Prof. Suzanne Wilkinson	University of Auckland	NZ
47	**Paetz**		Matthew		AECOM	NZ
48	**Pearce**	Asst. Prof	Annie	Assistant Professor Yong Han Ahn	Virginia Polytechnic Institute and State University	USA
49	**Pearce**	Asst. Prof	Annie	Associate Professor Kristen Sanford-Bernhardt[2]; Associate Professor, Michael Garvin	Virginia Polytechnic Institute and State University & Lafayette College, Easton, PA[2]	USA
50	**Pearce**	Asst. Prof	Annie		Virginia Polytechnic Institute and State University	USA
51	**Perry**		Robert	Paul Chambers	Auckland Council	NZ
52	**Powell**	Dr	Felicity	Dr Abigail Harding	Opus Central Laboratories	NZ
53	**Clarke**		Caleb	Lucy Preston; David Phillips; L.Fourie	Unitec / Morphum / Epsom Normal	NZ
54	**Quinlivan**		Paul	Shelley Quinlivan	Sinclair Knight Merz (SKM); Epsom Normal Primary School	NZ
55	**Reay**	Dr	Stephen	Andrew Withell, Prof. Olaf Diegel	AUT	NZ
56	**Reay**	Dr	Stephen	Andrew Withell, Prof Olaf Diegel	AUT	NZ
57	**Rendall**		Stacy	Assoc. Prof Susan Krumdieck; Dr. Elijah Van Houten; Dr. Femke Reitsma; Dr. Shannon Page	University of Canterbury	NZ

Sustainable Renewable Electricity for Small Islands : A Methodology for Essential Load Matching	Evolutions in Technology	Susan Krumdieck	Wed 1.30pm	1	401:401
Risks Associated with Implementation of Green Buildings	Beyond today's infrastructure	Sakina Mokhtar Azizi	Thurs 11am	3	403:401
Cost benefit pathways to zero emission housing: Implications for household cash-flows in Melbourne	Resilient Societies	John Morrissey	Wed 3.30 pm	2	403:402
Proposal of a tiered conceptual framework for sustainable design and planning of large-scale development projects in the metropolitan context	Mixed Session 1 BTI/Limits	John Morrissey	Wed 1.30pm	1	403:401
Study on Risk Management for the Implementation of Energy Efficient & Renewable Technologies in Green Office Buildings	Evolutions in Technology	Ibrahim Mosly	Wed 1.30pm	1	401:401
The "Limits to Growth" and 'Finite' Mineral Resources: Re-visiting the Assumptions and Drinking From That Half-Capacity Glass	Limits to Growth	Gavin Mudd	Fri 9am	4	403:402
Urban Form as a Reflection of Governance Practices	Resilient Societies	Colin O'Byrne	Fri 9am	4	401:401
Global Thinking- Local Action: Adopting the Low Impact Design (LID) Technologies in Urban Stormwater Management	Beyond today's infrastructure	Joshua Olorunkiya	Thurs 11am	3	403:401
Risk as a Fundamental Barrier to Adoption of Low Impact Design Technologies	Limits to Growth	Joshua Olorunkiya	Fri 9am	4	403:402
Sustainable Suburbia – Oxymoron or Realistic Goal?	Resilient Societies	Matthew Paetz	Fri 9am	4	401:401
Strategic Entry Points for Sustainability in University Construction and Engineering Curricula	Embedding sustainability	Annie Pearce	Wed 3.30 pm	2	403:403
Sustainability and Capital Projects: Modeling the Emergent Property of Total Cost of Ownership	Resilient Societies	Annie Pearce	Thurs 11am	3	403:404
Costing Sustainable Capital Projects: The Human Factor	Resilient Societies	Annie Pearce	Fri 9am	4	403:404
Carbon Now and Carbon Futures – a systems and performance based approach to reducing GHG Emissions in the Auckland Region	Resilient Societies	Robert Perry and Paul Chambers	Wed 1.30pm	1	403:404
The renaissance of inner city living and its implications for infrastructure and services: A Wellington case study	Resilient Societies	Felicity Powell	Fri 9am	4	401:401
You Can Teach A Young Dog New Tricks: Starting At The Beginning - Sustainable Education	Embedding sustainability	Caleb Clarke	Wed 1.30pm	1	403:403
Embedding Sustainability into School Curriculums	Embedding sustainability	Paul Quinlivan	Fri 9am	4	403:403
How to effectively engage students' with environmentally sustainable product design?	Embedding sustainability	Steve Reay	Wed 1.30pm	1	403:403
Design for Biodiversity: a new approach for ecologically sustainable product design?	Resilient Societies	Steve Reay	Thurs 11am	3	401:401
Quantifying Transport Energy Resilience: Active Mode Accessibility	Resilient Societies	Stacy Rendall	Wed 3.30 pm	2	403:404

57	**Robak**		Anna	Assoc. Prof. Henning Bjornlund	Opus International Consultants / UniSA / U.of Lethbridge	NZ
58	**Rosales-Carreon**		Jesús	Prof. René Jorna; Dr Neils Faber; Prof. Rob van Haren	University of Groningen	The Netherlands
59	**Rule**		Bridget	Assoc. Prof. Carol Boyle	ICSER, University of Auckland	NZ
60	**Russell**		John		La Trobe University	Australia
61	**Saito**	Assoc. Prof	Osamu		Waseda University	Japan
62	**Salon**		Judelyn	Dr. Ermelinda G. Tobias	Mindanao State University-Iligan Institute Of Technology	Philippines
63	**Saville-Smith**		Kay	Lois Easton	Beacon Pathway Limited	NZ
64	**Scott**		Eion	Jennifer Kerr; Rhys Taylor	Auckland Council	NZ
65	**Sinclair**		Sarah	Louise Webster; David Woods	Sinclair Knight Merz (SKM); Ideas Accelerator Ltd; North Shore City Council	NZ
66	**Siripun**		Komsun	Narantuya Batmunkh[1]; Peerapong Jitsangiam[3]; Hamid Nikraz[4]	Curtin University of Technology	Australia
67	**Slason**		Jonathan		BECA	NZ
68	**Smith, Tara**		Tara	Dr Gavin Mudd	SKM Australia	Australia
69	**Tanner**		Aaron	Dr Brian S. McIntosh[1]; Dr David Widdowson[2]	[1]Cranfield University, [2]Yorkshire Water	UK
70	**van Onselen**		Lenny	Kristina Lauche Ph.D MSc; Sacha Silvester Ph.D MSc; Rikoll Dehli Silje MSc;	Delft University of Technology	The Netherlands
71	**Varua**	Dr	Maria Estela	Anna Evangelista	University of Western Sydney	Australia
72	**Vickers**		Jeff	Assoc. Prof. Carol Boyle	ICSER, University of Auckland	NZ
73	**Weng**		Zhehan	Dr Gavin M. Mudd[1], Assoc. Prof. Carol Boyle[2]	[1]Monash University, [2]ICSER University of Auckland	Australia
74	**Williamson**	Prof	Arthur	Dr Ian Mason	University of Canterbury	NZ
75	**Wolfgramm**	Dr	Rachel		The University of Auckland Business School	NZ
76	**Young**		Damian		Morphum Environmental	NZ
77	**Zahedi**	Assoc Prof	Ahmad		James Cook University, Townsville	Australia

Trade-offs between public health and environmental protection in a potable water supply context: Drinking Water Standards New Zealand vs resource consent conditions	Beyond today's infrastructure	Anna Robak	Thurs 11am	3	403:401
Sustainability: Seeing Through The Eyes Of Farmers.	Resilient Societies	Jesús Rosales-Carreon	Fri 9am	4	403:404
Challenges for sustainable infrastructure development in small island developing states	Resilient Societies	Bridget Rule	Fri 9am	4	403:404
Transitions to Sustainability - Are we confident about the IPCC climate change predictions for the future?	Mixed Session 1 BTI/Limits	John Russell	Wed 1.30pm	1	403:401
Measuring lifecycle carbon footprint of a golf course and greening in the golf industry	Resilient Societies	Osamu Saito	Fri 9am	4	403:404
A Correlational Analysis of Collective Social Capital and Sustainable Development Program Outcome in Iligan City, Philippines	Resilient Societies	Ermelinda Tobias	Thurs 11am	3	403:404
Market Transformation to Achieve Large Scale Uptake of Sustainable Residential Renovation in New Zealand	Resilient Societies	Lois Easton	Wed 3.30 pm	2	403:402
Resilience in sustainability: A New Resource	Embedding sustainability	Eion Scott and Jennifer Kerr	Fri 9am	4	403:403
Rethinking sustainable infrastructure using innovation tools	Beyond today's infrastructure	Sarah Sinclair	Thurs 11am	3	403:401
Sustainable Use of Crushed Concrete Waste as A Road Base Material	Beyond today's infrastructure	Komsun Siripun	Wed 3.30 pm	2	403:401
Unintended Consequences of Reduced Consumption	New Economics	Jonathan Slason	Thurs 11am	3	403:403
Shallow Groundwater Resources and Future Climate Change Impacts:A Comparison of the Ovens and Namoi Catchments, Eastern Australia	Limits to Growth	Tara Smith	Wed 1.30pm	1	403:402
Adapting to adopt sustainability: organisational change in UK water and sewerage companies	Resilient Societies	Aaron Tanner	Wed 3.30 pm	2	403:404
Technology Windows in Sustainable Innovation Projects: Experiences with an Innovation Tool for Identifying Sustainable Application Domains	Evolutions in Technology	Lenny van Onselen	Wed 3.30 pm	2	401:401
(Un)sustainable Consumption in Australian Households: An Exploratory Study	Limits to Growth	Anna Evangelista	Thurs 11am	3	403:402
Design for Sustainable Development: A Framework for Sustainable Product Development and its Application to Earthmoving Equipment	Evolutions in Technology	Jeff Vickers	Wed 3.30 pm	2	401:401
Projecting the Full Pollutant Cycle from Coal Utilisation to 2050: Understanding the Global Environmental Implications	Limits to Growth	Zhehan Weng	Fri 9am	4	403:402
Transitions in transit: future options for transport energy in New Zealand	Beyond today's infrastructure	Arthur Williamson	Fri 9am	4	403:401
Creating leadership in transition to sustainability societies: Reflections from the Universitas 21 Sustainability Project	Embedding sustainability	Rachle Wolfgramm	Thurs 11am	3	403:403
Can catchment management can be delivered for the Auckland Super City watersheds and achieve sustainability	Resilient Societies	Damian Young	Wed 3.30 pm	2	403:404
Sustainable electric energy supply by decentralized alternative energy technologies	Evolutions in Technology	Ahmad Zahedi	Wed 1.30pm	1	401:401

AUTHOR: Hanani,Abd Wahab PhD(c) [1,3]

Co-Authors: Dr Mike Duke[1]
Dr Tim Anderson[2]
Dr James Carson[1]

Presenter: Hanani Abd Wahab

Title: Solar Roofing System Thermal Performance Analysis

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Abstract:
Research and development work on Building Integrated Solar Energy Systems (BISES) has become an area of growing interest, not only in New Zealand (NZ) but worldwide. This interest has led to a significant growth in the use of solar energy to provide heating and electricity generation. This paper presents the theoretical and experimental results of a novel building integrated solar hot water system developed using commercial long run roofing materials. This work shows that it is possible to achieve effective integration that maintains the aesthetics of the building and also provides useful thermal energy. The results of a 6.73m2 glazed domestic hot water systems are presented. The experimental results show that the glazed system performs close to the theoretical model and is an effective provider of hot water in certain climates. Further work is needed to identify and design a control strategy for the Building Integrated Thermal (BIT) system and determine how the performance can be optimized.

Keywords: BIT, thermal performance, roofing system

AUTHOR: **Craig Brown** (MSc Occupational Psychology, PG Dip Health Ergonomics)

Co-Authors: **Professor Stephen Legg**

Presenter: **Craig Brown**

Title: **Achieving transition to sustainability: lessons from human factors and ergonomics**

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Abstract:
Sustainability is multi-dimensional: social, economic and environmental. Optimisation of a single dimension may not result in optimisation of the other dimensions. Transition to sustainability must occur in the context of complex sociotechnical systems. Human factors and ergonomics (HF/E) is a discipline which operates in the context of sociotechnical systems and aims for joint optimisation of multiple dimensions. This paper describes HF/E and applies an HF/E perspective to transition and to jointly optimising the dimensions of sustainability in two case studies to illustrate the need to design at a sociotechnical system level: a NOW Home and a self-explaining roads project. NOW Homes are relatively conventional, more sustainable, homes built with today's products and materials. This NOW Home was only partially successful, partly because full account was not taken of user behaviour. The application of HF/E, as with a previous, more successful NOW Home, would probably have improved the outcomes. Self-explaining roads provide road users with information in the form of perceptual cues rather than signage about the function of the road in order to encourage appropriate/safer behaviour. Application of HF/E to the redesign of a rural intersection reduced the rate of injury crashes through the installation of shade cloth that reduced visibility (and hence also drivers' speeds) on the approach to the intersection.

AUTHOR: **Hugh Byrd*** (BAHons Arch. PhD)

Co-Authors: **Dr Michael Rehm****

Presenter: **Michael Rehm**

Title: **Changing Architecture for a Changing Climate; Unsustainable Trends in New Zealand**

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Abstract:

To be sustainable, buildings should usefully last for many generations. This requires building designers to have some knowledge of the future climate and the resources available to maintain the operations, in particular energy consumption, of buildings. The New Zealand climate is predicted to get hotter and an energy gap to emerge as fossil fuels deplete and hydroelectricity production declines due to the retreat of glaciers. The historical peak demand of electricity for buildings has been for winter heating. This is now shifting to summer cooling. Building design should be responding by designing with climate rather than against it. Appropriate consideration of solar shading, thermal mass and natural ventilation systems can provide comfort conditions within buildings with the minimum use of energy. However, the trend in New Zealand has been for commercial buildings to be designed without consideration to excessive solar heat gains resulting in lightweight, highly glazed built forms that are dependent on air-conditioning. This is typical of almost all the buildings that have been accredited with the New Zealand GreenStar ratings. This paper will review those aspects of Climate Change and fuel depletion that will have an impact on buildings both in the short and longer term. In particular the predicted average temperature increases and the impact this will have on energy demand for air-conditioning. The paper will also analyse the science behind these highly glazed building types and explain why, both in New Zealand and internationally, their monitored energy consumption significantly exceeds the predicted consumption at the design stage. The paper will argue that both building design and standards should change to allow adaptation to a hotter climate where dependence on mechanical cooling systems should be avoided due to an insecure supply of energy in the longer term. Building design needs to address the problem of overheating by passive means and comfort standards altered to account for human adaptation.

AUTHOR: **Marcel Crul,** Ph.D., M.Sc.

Co-Author: **Jan Carel Diehl,** Ph.D., M.Sc.

Presenter: Marcel Crul

Title: **Design for Sustainability: Moving from Incremental towards Radical Design Approaches**

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Abstract:
The concept of Design for Sustainability (D4S) goes beyond how to make a 'green' product and strives to meet consumer needs through sustainability-oriented interventions in a systematic and systemic way. It covers strategies ranging from incremental to radical innovation and from a focus on the individual product to an integral systems view. Practical approaches for industry, showing effective solutions and direct sustainability benefits are at the heart of the D4S approach. It can be used in a collaborative process with several partners, either within a company, or in a project where a broader partnership of both intermediates and companies are involved. The key inside-the-box, incremental innovation strategy is D4S Redesign. This strategy is aimed at sustainability-driven, stepwise improvement of an existing product. A closely connected approach, D4S Benchmarking, advocates learning from competitors' efforts and experiences to improve a company's own products, and is especially suitable for companies that develop products by imitating existing products. The incremental strategies are very relevant and useful, but out-of-the box or radical sustainable product innovation strategies are necessary to achieve significant sustainability gains.

New product development involves a higher level of technical, market and organizational uncertainty then redesign, at the same time a higher sustainability gain can be reached. New product development is strongly connected with system innovation, which is typically accompanied with radical changes in technologies, regulations, user practices, markets, culture, infrastructure and supply networks. Another radical approach is the development of Product-Service Systems (PSS). This strategy stems from the fact that services and products are becoming more and more intertwined. If properly designed, PSS can be much more sustainable then purely product-based solutions. This paper describes the theoretical and methodological development of the D4S concept, and presents several industrial cases.

AUTHOR: Michael Dale (MSci)

Co-Authors: Associate Professor Susan Krumdieck
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Presenter: Susan Krumdieck

Title: Global Energy Modelling – a Biophysical Approach

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Abstract:
The standard economic approach to energy modelling is outlined and contrasted with energy models taking a biophysical approach. The latter incorporate thermodynamic and ecological principles and emphasise the importance of natural resources to the economic process. Neither the standard economic nor biophysical approach accounts for changing energy-returns-on-investment (EROI) due to declining resource-accessibility and technological learning, nor the capital intensive nature of renewable energy sources.

These two factors will become increasingly important in the future as fossil fuel depletion continues and a transition to alternative sources occurs. A modelling methodology offering an extension to the biophysical approach is presented, which utilises a dynamic EROI function that explicitly incorporates both technological learning and declining resource accessibility. The methodology and main assumptions of the model are outlined and their validity is discussed. The model is calibrated using historical energy production data. Forecasts of future energy production from the model are presented and their policy implications are discussed.

AUTHOR: **Laurentiu David** PhD(c)[1]

Co-Author: **Frantz Daniel Fistung,** Ph.D, M.Sc.Eng[2]

Presenter: **Larry David**

Title: **On the Road to Sustainability - The Case of the Romanian Transport Sector**

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Abstract:
This paper undertakes a macro-level analysis of the present transportation sector in Romania while exploring potential strategic options within the context of integrating the existing European environmental policies that address the sustainability factor. The intention is to develop a framework that will help the Romanian sector of transport to identify the targets and strategies for the development and deployment of such policies in order to minimize the effects of the existing pollutant modes of transportation. The fast adoption of such pertinent strategies for the development and implementation of a public transportation, rail, naval and multimodal transportation seems to be the key factor in the introduction of a sustainable transport system in Romania.

Despite some very serious obstacles that are presently challenging the Romanian transport system, the development of a transportation infrastructure that is built upon the principles of sustainable development will ask for a reorientation in favor of new transportation modes that are less pollutant and much more energy efficient. It is assumed that in order to allow for such retrenchment to occur some key changes in the Romanian transport policy priorities will need to take place.

Keywords: sustainable transportation, energy efficiency, transportation infrastructure, European policies

AUTHOR: Vince Dravitzki

Co-authors: Tiffany Lester
Peter Cenek

Presenter: Vince Dravitzki

Title: Pathways to a more Sustainable Transport Infrastructure

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Abstract:
The imperative to respond to the issues resulting from Peak Oil and Climate Change requires that New Zealand must move from its current high energy use, high resource use, high cost, petroleum dependent, transport infrastructure, to a sustainable one. Because a country's energy profile will increasingly define its economic success, New Zealand needs also to move to a lower energy society to remain competitive with other countries. What will be New Zealand's successful transport energy of the future and how it may be best used are key considerations of our future sustainable transport system. Low energy, low material use and consequently low cost, will be the main criteria. This paper first identifies our current transport energy usage, and some of the risks of being slow to respond to change. The paper then questions the central tenants of the current New Zealand Land Transport Strategy (2008) that we move to bio-fuels and electric cars because this is not a low energy, low cost pathway. We advocate that instead of just coping with change, that New Zealand uses the necessity to change as an opportunity to recast our transport infrastructure to greatly improve the economic success and liveability of our settlements to New Zealand's benefit. The second part of the paper outlines a transport infrastructure based around electricity, with a heavy emphasis on public transport use, but also with freight much more dependent on electrified rail. This second part discusses: the advantages that NZ has that will facilitate this transition, such as favourable urban forms; the energy needs and energy availability; the benefits and liveability improvements that should accrue; and the need for lead investment which can also be a tool which induces change of settlement form, thereby reinforcing the effectiveness of the new infrastructure; and some of the impediments.

AUTHOR: **Daniel Ducker** PhD(c)

Co-Authors: Dr Kepa Morgan

Presenter: Dan Ducker

Title: **Bridging formal research and informal approaches to enhance civic engagement processes**

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Abstract:
Enhancing civic involvement in decision making has become one of the dominant strategies for resolving sustainability issues. While a large literature has emerged identifying processes, strategies and criteria a few methodological concerns remain. Most pressingly is the apparent divide between formal, institutionalised engagement and the engaged citizenship which emerges through grass roots movements. Formal research on institutionalised engagement has been extensive, and a number of typologies have been put forward. Research on informal methods of engagement has not had the same attention however. In fact, due to distinct differences between inquiry methods and questions, formal research and 'informal' engagement are frequently viewed as adversaries.

To help bridge these quite disparate approaches we note two areas which have been seemingly under-valued by present formal research but which are vital to gaining a more comprehensive understanding of engagement: 1) experiential aspects of participation in engagement processes and 2) a broad understanding of long-term success. Following an analysis of several potential research approaches and taking into consideration the possibilities of new online collaborative technologies, we suggest that a combination of phenomenological and backcasting tools may provide one possible bridge between the informal and formal aspects of engagement research and help to clarify these outstanding issues.

AUTHOR: **Lois Easton** (MSc, Hons)

Co-Authors: **Roman Jaques** (BBSc, Hons)

Presenter: **Lois Easton**

Title: **The Eco Design Advisor Programme: Supporting the Transformation of New Zealand's Housing Stock**

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Abstract:
The Eco Design Advisor Programme has been running in eight local Council areas, since September 2007. The programme provides free, independent, face to face advice on sustainable building options to homeowners, designers, community organisations, building contractors and developers of new homes and in relation to renovations.

The programme was set up to address a significant problem in the lack of independent and robust information available to these key market segments and has recently been evaluated in relation to its objectives. This evaluation looked at both the extent and type of interventions, and the incremental effect on the knowledge base on sustainable building within the wider community.

This paper will present the programme and the findings from the evaluation to assess the effectiveness of the programme. The paper also discusses the future role of the Eco Design Advisor Programme, its role within Local Government and the ways in which its positive impact on New Zealand's housing stock can be increased.

AUTHOR: **Fahimeh Foudazi** (B.Sc. in Industrial Design)

Co-Author: Dr Mugendi M'Rithaa

Presenter: Fahimeh Foudazi

Title: **Sustainable Solutions for Cooling Systems in Residential Buildings: Case Study in the Western Cape Province, South Africa**

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Abstract:
The energy demand in building sectors for summer air-conditioning is growing exponentially due to thermal loads, increased living standards and occupant comfort demands throughout the last decades. This increasing consumption of primary energy is contributing significantly to emission of greenhouse gases and therefore to global warming. Moreover, fossil fuels, current main sources of energy used for electricity generation, are being depleted at an alarming rate despite continued warning. In addition, most air-conditioning equipment still utilise CFC's, promoting further destruction of our planet's protective ozone layer. Concerns over these environmental changes, have begun shifting the emphasis from current cooling methods, to 'sustainable strategies' of achieving equally comfortable conditions in building interiors. Study of ancient strategies applied by vernacular architecture shows how the indigenously clean energies to satisfy the cooling need were used. One of the most important influences on vernacular architecture is the macro-climate of the area in which the building is constructed. Mediterranean vernacular architecture, as well as that of much of the Middle East, often includes a courtyard with a fountain or pond; air cooled by water mist and evaporation is drawn through the building by the natural ventilation set up by the building form, and in many cases also includes wind-catchers to draw air through the internal spaces. Similarly, Northern African vernacular designs often have very high thermal mass and small windows to keep the occupants cool. Not only vernacular structure but also the recent development in solar and geothermal cooling technologies could be used to the needs for environmental control. Intelligent coupling of these methods as alternative design strategies could help developing countries such as South Africa toward sustainable development in air-conditioning of building. In this paper, the possible strategies for sustainable cooling in residential buildings of Western Cape, South Africa are discussed.

AUTHOR: Gayathri Babarenda Gamage (BE)

Co-Authors: Associate Professor Carol Boyle
Dr Ir Ron McDowall

Presenter: Gaya Gamage

Title: The Development of an Integrated Model for Assessing Sustainability of Complex Systems

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Abstract:
Synergetic interaction of factors such as financial management, supply chain management, process management, research and development, strategic marketing and sales, employee and customer relations, etc. contribute to business success. Aligning business with principles of sustainable development (SD) is considered a worthwhile goal by many in the SD arena. One significant advantage with the alignment is the potential for enhanced resilience to shocks that may disturb income generating activities. However, there is growing awareness that sustainability of the Earth as a system needs to be considered when attempting to sustain business. This awareness may be significant for the survival and well being of the human species in the long term. Assessment of sustainability is an essential step in determining if action taken is sustainable. Early research in sustainability assessment was based on reconciling the three pillars (environmental, social and economic). Today there are numerous indicators (single and composite) for measuring impacts in the three pillars though current thinking emphasises the need for system thinking rather than the reductionist concept of pillars. Most existing indices/methods measure single aspects of sustainability and the more integrated indicators are aimed at national or global level assessments. A review of existing indicators, methods and models within the context of complex system sustainability showed that no single existing index, method or model was able to assess sustainability of complex systems. This is because most fail to account for complex system characteristics such as system dynamics, interconnections and interdependencies of system components, a system's ability to learn and remember, emergence of novel behaviours, co-evolution, etc. This paper presents the methodology used to develop a new model for assessing sustainability of complex systems based on risk.

AUTHOR: A. Idil Gaziulusoy

Co-Authors: Assoc. Professor Carol Boyle
Dr Ir Ron McDowall

Presenter: A. Idil Gaziulusoy

Title: System Innovation for Sustainability at Product Development Level: A Scenario Method and a Workshop Process

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Abstract:

It is now commonly accepted that, in order to achieve sustainability, we need societal transformation, which requires institutional, social/cultural, organisational as well as technological change. This type of massive societal transformation in which all aspects of society are expected to co-evolve towards and align with sustainability goals is defined as sustainability transition or system innovation for sustainability. One of the major actors in system innovation is industry. Nevertheless, neither the theory nor the operational approaches currently based on this emerging theory address how to link macro-level innovation (i.e. institutional and social-cultural innovation) to the micro-level innovation (i.e. product/service and technology innovation). This paper presents the results of a recently completed Ph.D. study. The overall objective of this study was to effectively link the activities/decisions at product development (micro-innovation) level in companies with the transformation which needs to take place at the societal (macro-innovation) level to achieve sustainability. The research took place in three distinguishable phases. In the first phase a broad literature review was carried out covering areas of sustainability science, futures studies and system innovation theory. In the second phase, a theory of system innovation at product development level was developed based on the findings and insights gathered from the review of the literature. This theory was used to develop a scenario method to help product development teams in planning for system innovation for sustainability. During this phase a workshop tool was also developed as the operational component of the scenario method. The third phase consisted of a fieldwork carried out to test, improve and evaluate the scenario method using an action research methodology. The detailed evaluation of the effectiveness of the scenario method as a futures work and the potential of it to aid in system innovation for sustainability provided supportive evidence for the claim that the scenario method is a valuable and a viable method.

Keywords: system innovation for sustainability, action research

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Presenter: Damien Giurco

Title: Peak Minerals: Mapping Sustainability Issues at Local and National Scales

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Abstract:
Peak minerals adopts the Hubbert metaphor for peak oil to highlight issues associated with initial mining of 'cheaper, more accessible and higher quality ores' pre-peak, to 'lower grade, more remote, complex and expensive ores' post-peak. In doing so, it prompts focus on the 'services' provided by the resource in-use as well as the transition strategy to supply those services following the decline of production post-peak.

This paper applies the peak minerals metaphor as a basis for examining the social and environmental implications pre- and post-peak production across spatial scales. Using document review and stakeholder analysis from a National Peak Minerals Forum held in Australia, social and environmental impacts are mapped at local and national scales.

This innovative mapping found that currently, consideration is given to local social and environmental issues and global economic issues, however, triple bottom line issues at the national scale are currently overlooked. As minerals resources belong to the people of a nation, this finding will inform future approaches to transition strategies seeking to maximise long term value for the use of the resources.

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Presenter: Susan Krumdieck

Title: Pattern Recognition Residential Demand Response: An Option for Critical Peak Demand Reduction in New Zealand

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Abstract:

Influencing households to adopt sustainable energy consumption behaviour is important to the transition towards a sustainable energy future. However, if one aims at influencing the energy consumption habits of people, one should also be able to estimate the resulting effects on the entire energy system. Residential demand response to reduce load on the electricity network has largely been impeded by information barriers and a lack of proper understanding of consumers' behaviour. What are not well understood and are of great interest include load disaggregation, the behaviour of customers when responding to demand response request, load shifting models and their impact on the load curve of the utility. There is concern among demand response practitioners, for example, that demand response in the residential sector may simply move the peak problem with scale from one point in time to another. However, unavailability of appliance-level demand data makes it difficult to study this problem.

In this paper, a generalized statistical model for generating load curves of the individual residential appliances is presented. These data allow one to identify the relative contribution of the different components of the residential load on a given residential feeder. This model has been combined with demand response survey in a neighbourhood with 400 households in Christchurch, New Zealand, to determine the effect of customers' behaviour in reducing the neighbourhood's winter peak demand. The results show that when customers' are given enhanced information, they would voluntarily act to reduce their peak demand by about 10% during the morning peak hours and 11% during the evening peak hours. The demand responsiveness of the individual appliances is also presented. The effectiveness of customer behaviour modification in maintaining system reliability is also presented.

AUTHOR: Frances Harrison

Presenter: Dr Maggie Lawton

Title: Community Advocacy for Sustainable Living

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Abstract:
Waitakere City Council's vision is for residents to actively participate in sustainable living, including water conservation. The council is, through its EcoWater division, encouraging a 25 percent reduction in mains water demand by 2025. Innovative social marketing initiatives have been set up to educate, support and motivate residents to modify daily behaviours towards greater sustainability. They have also identified environmental leaders across differing age groups who encourage others in their communities to lead more sustainable lives. Water Ambassadors Kids Club (WAKC), aimed at children aged 5-15 years, was a blend of online interaction, events, education and publicity components and has been running for the past 18 months. There are currently more than 1300 members including international ones. This environmental programme is warmly supported by members' families and schools and injects elements of fun and personal development into daily life. A group of competent public speakers, some as young as 7 years old, went out into the community to advocate for living sustainably in terms of water. The Water Ambassadors of NZ (WANZ) was a network of individuals aged from 16 years, community groups, consultants and businesses with an interest in using water more sustainably. It provides access to research papers, opinion pieces, news on new technologies and profiles for members. Predominantly online based, there were plans to develop more opportunities for members to meet and work together directly. A collaborative approach with Waitakere's largest retirement village (a member of WANZ) has seen dramatic changes there in water-use and waste minimisation. Raintanks for rainharvesting to supply water to 100 flourishing individual gardens have been set up and waste to landfill has been dramatically reduced. The approach has been so successful that Vision Waitakere Gardens won the supreme award at the Auckland Regional Council 2010 Sustainable Environment Awards. Waitakere fostered people taking sustainability advocacy to other people.

AUTHOR: Dr Jan Havenga

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Presenter: Jan Havenga

Title: Research priorities for sustainable branch line revitalisation in South Africa

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Abstract:
In June 2010 the holding company of South Africa's national railroad announced its intent to concession its 7300 km of branch lines in an attempt to focus on its core business while unlocking potential value for smaller operators. The research presented in this paper demonstrates the importance, when taking decisions on the concessioning or closure of branch lines, of understanding potential current and future flows, as well as considering the impact on sustainability by analysing freight transport externalities and road usage costs.

The research results reveal considerable volume opportunities for branch lines which, if captured, will significantly reduce both the direct transport costs for this traffic as well as externality charges for the economy. This will therefore not only render rural economies more competitive but also enable the provision of more sustainable freight transport to these communities. The research approach will be of value to researchers in both developed and developing economies to inform the continuous debate regarding the role of rail in sustainable transport provision.

AUTHOR: Dr Robert Howell

Presenter: Robert Howell

Title: Transitions to Sustainable Investment

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Abstract:
During the last few years the international financial system has demonstrated its inability to carry out one of its basic functions, namely, to receive deposits from investors and channel those safely and efficiently to organisations that provide goods and services for the benefit of society. This is because for the last three to four decades the model used was the theory of the free market. This failure has been at a conceptual and practical level. While regulations and controls need to be established, these are not sufficient for sustainable investment because the economic and financial systems are still not based on the need for humans to live within the capacity of Earth to support human life. This failure is of strategic significance because the financial sector plays a key role in any transition to a sustainable world.

It is estimated that less than 1% of investment under professional management is sustainable. The proportion of Sovereign Wealth Funds that are sustainable is likely to be less than 5% and closer to less that 1%. There are major problems with international financial standards, such as the UN PRI and the Equator Principles. Reference is made to a fund, Portfolio21, that attempts to invest sustainably, and to a bank, HSBC Holdings, that is leading in sustainable commitment. Both demonstrate how far we have to go. A transition to where investments are sustainable will require substantial reform of the international financial institutions and standards, and this change is unlikely to occur in the immediate future. Investment strategies need to take into account the turbulence that will result from a deteriorating ecology that will be unable to support human life on Earth as we know it.

AUTHOR: **Bruce Hucker** M.A. (Hons.), B.D. PhD (magna cum laude)

Presenter: Dr Bruce Hucker

Title: **Auckland governance reforms: political legitimacy, democratic accountability and sustainable development**

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Abstract:
Themes of the Auckland governance reforms are set out: radical change, historical discontinuity and the centralisation of power. These have influenced the design of the new Auckland Council and its associated institutions, and the sustainability provisions embedded in legislation. These are not likely to change soon, and constitute a given. The question is how successful they will be in practice and what further needs to be done if the hope placed in them is to be fulfilled over time. This will depend in large part on the linked achievement of political legitimacy, democratic accountability, and sustainable development. These will not occur naturally and will require considerable effort and the implementation of a series of actions that reflect cross disciplinary insights, theoretically- based understanding, and the exercise of practical and political wisdom (Aristotle's phronesis and politike).They include the adoption of an inclusive common good approach to the region and its parts, improving three particular relationships, and the detailed understanding of the context, shaped by the past, in which the new political network will operate. It will require a practical focus on how to grow the legitimacy of the new institutions, on aligning the network towards democratic accountability and sustainable development through its transitional and other stages, and making the structures and processes congruent with and responsive to the browning of Auckland. Nimble, responsive and rapid approaches are needed rather than the current plethora of plans with their emphasis on coordination rather than implementation. The Council Controlled Organisations need to serve the Auckland Council and the region's communities rather than vice-versa. A robust community development approach is required for strategic issues that require a people-centred approach, rather than engineering and technical solutions alone. Together these suggestions are a recipe for achieving earlier greater political legitimacy, democratic accountability and sustainable development.

AUTHOR: **James Hughes** (BE Civil –Hons)

Co-Authors: Steve Goldthorpe
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Presenters: James Hughes & Robert Perry

Title: **Carbon Futures: Reducing Emissions for the Auckland Region**

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Abstract:
Over the last three years, the ARC has led a consortium of councils and key stakeholders to develop integrated regional policy responses to address energy and climate change issues, that would map the way forward by determining how the Auckland region will adapt, manage and respond to risks associated with climate variability and the pressures faced due to rising greenhouse gas (GHG) emissions. As part of the Regional Response to Climate Change (RRCC) work, two significant projects have been developed:

4. Carbon Now – A performance and systems-based framework for measuring GHG emissions, preparing reduction targets, monitoring and reporting against targets.
5. Carbon Futures – A back-casting and visioning study which projected estimated 2006 baseline emissions through to 2040 and then developed a suite of mitigation initiatives to achieve a range of reduction targets.

The first stage of the Carbon Futures project involved a detailed estimate of the current emissions for the region, based on data supplied through the International Council for Local Environmental Initiatives' Communities for Climate Protection programme and other sources. Data was supplied by each of the seven Councils within the Auckland Region and an aggregated regional emissions profile was developed using 2006 data. This 2006 emissions profile was then projected out to 2040 based on a range of assumptions linked to each individual sector. The final stage of the project involved developing a suite of options for reducing emissions across the region and assigning responsibilities for various options to relevant authorities and sectors. The study provided a very interesting 'reality check' for decision makers in the region - putting the ever-increasing 'business as usual' emissions projections well and truly into perspective and outlining a range of available options to address these.

AUTHOR: **Shaharudin Idrus** (M. Env Mgmt)

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Title: **A Malaysian Initiative in Embedding Sustainability: Sustainable School - An Environment Award**

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Abstract:
A central mechanism in embedding sustainability is education. This paper is about a collaboration between the Malaysian Department of Environment (DoE) in the Ministry of Natural Resources and Environment; the Ministry of Education, Malaysia, and Institute for Environment and Development (LESTARI), The National University of Malaysia providing the conceptual and technical support. The main argument is that if we can make school children aware of the importance of protecting the environment (and hence the relations to the other two pillars of sustainable development), they can be agents promoting sustainable development in the country and elsewhere. The Sustainable School - Environment Award initiative is designed to recognize the achievements of primary and secondary schools in Malaysia in a particular year based on five pillars of environmental related activities, namely the curriculum, the co-curriculum (extra-curricular), the school administration of environmental activities, the greening programs and the special eco-projects. The Environment Award is open to all the primary and secondary schools in Malaysia. Feedbacks from the evaluators at both the State level assessment and at the Federal level, as well as the data from the analyses of the 'school brief' highlight the following observations. First, there has been a steady increase in the number of participation from the primary and secondary schools over the three Environment Award sessions. Second, schools have enhanced their environmental activities to demonstrate their sustainability. Third, environmental activities in the schools are functional in that they are being used to complement the class room learning. Fourth, schools have created a more conducive surrounding for academic activities. Finally, there are noticeable spillover effects of activities in the schools to the surrounding communities.

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Title: Non-linearity of Urban Expansion: Transition to Sustainability

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Abstract:
This paper presents the dynamics of housing expansion as a non linear emergent process that begin as separate individual local decisions which determine the patterns of area growth, sprawl, and emerging land use patterns, taking an intermediate city, Seremban Municipal Council (MPS) in Negeri Sembilan, Malaysia as a case study. There is still much to study about how housing neighborhoods are formed and then evolve, how we might best understand and then simulate them, and most importantly, how we should design plans which enable them to function in more efficient and sustainable ways. The population of the urban areas grows, and influence the physical expansion of housing that in turn influences the expansion of the urban areas even to the extent of going beyond their legal administrative boundaries engulfing the once isolated villages (kampungs) into huge urban areas. The inter-relationship and inter-connection between state, market and society need to be articulated from a bottom-up approach to understand the housing dynamics in this area as well as in Malaysia as a whole. Although, longer time series information is needed to understand the dynamics of the housing development, the present study is still beneficial for future urban development in the State. The vibrant housing development in the city is most welcome to generate the needed economic opportunities for the developers, prospective owners and buyers, and the government as well as the financial and legal institutions. A new decision making approach of governance is needed to govern the dynamics of housing development to develop a better resiliency of the city community. All of these call for planning concerns at the regional scale responding to change due to global conditions. It is argued that in the future, housing development needs to be planned based on this type of non-linearity.

AUTHOR: Patricia Kelly,
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Presenter: Patricia Kelly

Title: **Embedding Sustainability: 'painless is just delay'**

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Abstract:
I engage with Sustainability in Higher Education context, based on my experiences working in transformative education with undergraduate engineers and in academic staff development at several Australian universities. Not belonging to a particular discipline offers opportunities to see gaps and try to find effective ways of bridging them. Working in academic development means thinking about what teachers need to know, do and be in order to face the increasing challenges of teaching in the 21st century. Futures thinking offers a meta-dimension to the resulting insights.

This paper is based on rejecting business-as-usual futures based on growth. The introduction argues that this means giving up old patterns and replacing growth as our guiding metaphor, with alternatives such as health, healing and sustainability. Embedding sustainability in Higher Education depends on support from the top and the need to understand the 'resistings' to what some see as sustainability's proselytising "boy- have- I -got –an- idea- for- you" zeal. These include recent aggressive arguments that sustainability is "eco-corruption" and "corroding the curriculum". Concerned universities are already working on new visions, while many others are just beginning to tinker with curricula.

Transformative responses need suitably skilled leaders to support them. This paper offers Dervin's Sense-Making Methodology as a useful approach to understand the process of transformation and to gather the evidence we need for credibility. Finally, this is a global undertaking. Whether we are working towards graduates who are 'critical beings' or Globo sapiens, we will need wisdom, the humility to seek it from any cultural tradition and the personal and professional skills to apply it.

AUTHOR: **Sung-soo Koh** (PhD Candidate, MSc (Hon))

Co-Authors: **Assoc. Professor Carol Boyle**

Presenter: **Sung-soo Koh**

Title: **Limits to Growth defined by Water Resource: Waiheke Island Case Study**

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Abstract:

In this paper, three models were developed to estimate the sustainable population limit bound by the freshwater collection capacity;

(1) an annual water balance model,
(2) water use-component model and
(3) a daily-step rainwater harvest simulation.

The current freshwater supply capacity of Waiheke Island fails even at 5-year return drought events and the current water collection capacity cannot properly sustain the further growth of population or other activities. Sustainable population count under current collection capacity was 6,730 people with 95% supply reliability (failure occurring once in 20 years). Capacity expansion options are possible but they cannot expand indefinitely and are bound by the physiographical environmental limits. These environmental limits for capacity growth are translated into supportable population estimates of 100,000~140,000 at 95% supply reliability.

AUTHOR: **Ana Krpo** (MApplSc (Hons), PgDipSci, BCom)

Co-Authors: Yasenko Krpo
Tony Miguel
Helen Chin

Presenter: Ana Krpo and Yasenko Krpo

Title: Urban Stormwater Runoff Quality – Lifecycle Assessment

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Helen Chin, Waitakere City Council | Tony Miguel. Waitakere City Council

Abstract:
Urban catchments are exposed to a wide range of pollutants from various sources, which are commonly described as diffused or non-point source pollution (NPSP). This paper is about a geo-spatial methodology applied to assess contaminant loads and analyse best practical options using the whole life cycle costs assessment. The geospatial / lifecycle approach leads the NPSP modeling towards advanced and optimised decision making that is necessary in determining and responding to the complex environmental issues.
NPSP is a significant contributor to water quality degradation in urban environments and poses a great challenge for control and abatement.
A sustainable approach to Catchment Management needs to incorporate NPS Load Modeling in order to understand impacts of urbanisation and other activities on the environment and in this particular case on stormwater runoff. However, this area deserves more clarity within the industry and there are a number of challenges such as:

1. The need for a consistent approach to analysis, tools and the data to be used in assessments;
2. The need for clarity in interpretation, presentation and understanding of the outputs;
3. The need for better communication of the appropriate information to various users and stakeholders.

The geospatial approach combined with lifecycle costs assessment enables the collection, analysis and modelling of relevant data with an advantage of combining existing and acquired geospatial data onto a single platform, thus enhancing strategic decision making for integrated and sustainable urban catchment management.

AUTHOR: **Susan P. Krumdieck** (BS, MS, PhD Mechanical Engineering)

Presenter: Susan Krumdieck

Title: **The Survival Spectrum: the key to Transition Engineering of Complex Systems**

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Abstract:

This paper puts forward a simple idea describing the time, space and relationship scales of survival. The proposed survival spectrum concept represents a new way to think about sustainability that has clear implications for influencing engineering projects in all fields. The argument for the survival spectrum is developed sequentially, building on theory, definition, examples and history. The key idea is that sustainability will be effectively addressed in engineering as a further development of the field of safety engineering with longer time scale, broader space scale, and more complex relationship scale. The implication is that the past 100-year development of safety engineering can be leveraged to fast track the inclusion of sustainability risk management throughout the entire engineering profession. The conclusion is that a new, all-disciplinary field, Transition Engineering, will emerge as the way our society will realise reduction in fossil fuel use and reduction in detrimental social and environmental impacts of industrialisation.

AUTHOR: Associate Professor Susan Krumdieck (PhD)

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Presenter: Susan Krumdieck

Title: TACA Sim: a survey for adaptability assessment

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Abstract:
Uncertainty of future fuel supplies and a requirement to reduce green house gas emissions are two pressures that may cause significant travel behavior change in the long-term. Understanding how people can change to carry out their activities without using a car; i.e. how adaptable they are, and how this adaptability depends on urban from, will aid local authorities planners and policy makers to develop transport systems and urban forms that are resilient to fuel shortages and high prices. This paper describes TACA Sim online travel survey in which one of the questions was "Could you get to the activity another way" The answer to this question for each trip taken was used to measure the adaptability of the survey participant. The results from a case study of two areas: the city of Christchurch and the small rural town of Oamaru showed that most participants did have another transport mode. Although participants were given the option of participating in the activity without travelling (i.e. working from home) this choice was not a popular alternative. From comparison between two groups, the surveyed group in Oamaru had a lower adaptability than the surveyed group in Christchurch, primarily due to the lack of public transport services in Oamaru. The results from this study are expected to contribute Oamaru authorities in improving local transport services and long-term planning for resilient urban form in the future.

AUTHOR: **Ella Susanne Lawton** (MSLS, LLB, BSc)

Co-Authors: Professor Robert Vale
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Presenter: Ella Susanne Lawton

Title: **The New Zealand Footprint Project: the Ecological Footprint of Kiwi Lifestyles and Urban Form**

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Abstract:
This new research project intends to highlight the degree to which and in what ways New Zealanders are living beyond their 'fair earth share' of global resources and how they could reduce their share. International case studies support the use of the Ecological Footprint (EF) to provide a 'snapshot' of a population's environmental requirements based on their use of resources and services. The EF has been proven as an effective indicator providing the means to communicate complex environmental data in a simplified form to diverse groups (Collins, Flynn, & Netherwood, 2005) and for high level long-term community planning and strategy formation (Aall & Norland, 2005; Wilson & Grant, 2009). The importance of varying approaches when engaging with specific socio-economic groups has been clearly articulated (Barrett, Birch, Baiocchi, Minx, & Wiedmann, 2006). The '8 Tribes' research (Caldwell & Brown, 2007) provides some knowledge of the differing social, economic and cultural behaviour in New Zealand. Initial research, building on the 8 Tribes findings, has clearly highlighted the wide diversity of EFs within New Zealand and will be used for designing processes of community engagement targeted at specific 'tribes' which encourage behaviour change towards a fairer share of global resources. The Framework for Strategic Sustainable Development (Robèrt, 2009a) will provide a guide for the project's collaboration process with local government and community stakeholders (Lawton, 2010). Working together with a range of demographically diverse New Zealand communities, a top-down and bottom-up approach to data gathering will allow for detailed measurement of a community's EF whilst highlighting which activities are the largest contributors to it. The outcome will be a set of footprinting tools to help guide future development decisions (Vale & Vale, 2009). This paper will cover project design, footprint calculation methodology and the initial results of investigations into New Zealand lifestyles within a 'fair earth share' EF.

AUTHOR: Dr Ian Longley

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Presenter: Ian Longley

Title: What is Sustainable Air Quality?

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Abstract:

For 40 years or more air quality policy has been based on the paradigm of the Air Quality Standard as a uniform criterion of acceptable environmental degradation, built on the foundations of the precautionary principle. However, developments in health science have undermined some of the underlying assumptions of this paradigm. Standards have provided powerful stimuli for deep emission cuts, but these cuts have led to less impressive improvements in air quality, whilst more subtle adverse health effects continue to be identified. Successes in technological emission control have continually been offset by growing economic activity. More recently, atmospheric carbon has overshadowed and been in conflict with the substantial contribution local air quality policy can make to transforming urban societies. Current trends are towards increasingly demanding notions of what constitutes acceptable air quality. Future air quality standards could require a revolution in urban form as the plans of today will define the air quality of the future for generations. We need a new paradigm – sustainable air quality. NIWA-led scientists have begun to explore what that paradigm might look like. In order to seed further discussions amongst stakeholders this paper discusses the need for a new paradigm and what sustainable air quality management might hope to achieve. It is suggested that a more holistic approach must better integrate economic/infrastructural and especially social determinants, constraints and goals. A recommendation to further such an approach is:

- to enable a more explicit consideration of how air quality interacts with the economy, the environment and with society.
- to describe how further downward pressure can be exerted on emissions through urban form, urban design, transport infrastructure, energy strategy, etc.
- to explore how social factors can be better integrated and considered in policy appraisal and in redefining what is meant by acceptable air quality.

AUTHOR: **Phuong Ly** (PhD Candidate)

Co-Authors: Professor Janis Birkeland
Associate Professor Nur Demirbilek

Presenter: Phuong Ly

Title: Towards Sustainable Housing for Vietnam

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Abstract:
Economic development in Vietnam has led to the spontaneous development of new housing in many parts of Vietnam without consideration of environmental protection, cultural suitability, or resource reduction. The transition of Vietnamese housing into a sustainable industry is both an opportunity and challenge. Vietnam has to satisfy a growing demand for housing while confronting the issues of climate change, extreme weather events, nature conservation and cultural heritage. To that end, model green building guidelines are being developed to facilitate Vietnam's adoption of sustainable development principles and practices. This paper presents the results of a survey and interviews carried out in Vietnam to ensure that model green guidelines align with the cultural and consumer preferences of the Vietnamese people.

AUTHOR: Tim Martin

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Presenter: Tim Martin

Title: Investigation of the National Pollutant Inventory (NPI) as a Sustainability Tool

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Abstract:
The National Pollutant Inventory [NPI] was established in the late 1990's, requiring all facilities across Australia to publicly report listed pollutants if they exceed an estimated threshold. Combined with an online database, the NPI provides an important mechanism to track pollution by facility, industry or geographic region.

There remains, however, surprisingly little published analyses of NPI data – especially with respect to performance of facilities or industry sectors over time. Are pollutant loads from industries declining over time with the introduction of better technologies and more efficient processes, or are efficiencies being over-whelmed by growth in industrial production?
This paper will present analyses on the coal industry (both mining and power generation operations) and their reported NPI data, show trends within the data (in terms of five key-indicating pollutants – NOx, SO2, PM10, VOCs, CO) and provide a comparison of the different operations using common metrics to ascertain the use of the NPI as a sustainability tool.

AUTHOR: Dr Ian Mason

Co-Authors: Dr Shannon Page
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Presenter: Ian Mason

Title: **Transitioning to a 100% renewable electricity generation system: balancing the roles of wind generation, base-load generation and hydro storage.**

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Abstract:
In this paper we demonstrate how various combinations of wind and new base-load generation can be used to ensure that hydro storage levels in a 100% renewable electricity generation system remain within historically acceptable values. Three levels of new base-load were modelled, 500, 1000, 1500MW, resulting in required wind capacities of 3266, 1801 and 400MW respectively. The magnitude and frequency of deficits in supply, and the amount of hydro spillage decreased with decreasing wind capacity. A tension is thus revealed between the plentiful wind resource in New Zealand and the impact on both peaking power requirements and hydro spillage. Demand-side measures are discussed. We conclude that transitioning to a fully renewable electricity generation system requires careful consideration of the types of generating plant in the mix, peaking capacity, available storage and implementation of demand-side management.

AUTHOR: Dr Tim McLernon

Presenter: Tim McLernon

Title: Intergrating Sustainable Development into the Higher Education Build environment Curriculum

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Abstract:
Universities play a pivotal role in influencing policies, practices and human behaviour that govern how we live. Historically, the influence of universities in this respect was acknowledged by the Talloires Declaration of 1990 which stated that:

"Universities have a major role in the education, research, policy formation, and information exchange necessary to make these goals [of a sustainable future] possible".

This paper explores the pedagogical and practical questions of how best to embed sustainable development in the higher education curriculum of the built environment disciplines, within the constraints of the current operating environment, in order to provoke a cultural shift in student behaviour. It is a small, qualitative study intended to add to the discussion on how best to embed sustainable development in the higher education curriculum. Interview data were collected from four key informants from academia and one from the professions. These data were supplemented by the analyses of policy and operational matters associated with the institutional promotion of sustainability. The findings of the study were applied to a previously devised, theoretical model for programme-based assessment and the paper concludes with a proposed model for embedding sustainable development in the higher education curriculum of the built environment disciplines. The findings should inform other disciplines.

AUTHORS: Taryn McQuinn | Claire Jewell

Presenters: Taryn McQuinn | Claire Jewell

Title: Sustainable Steelmaking: Infrastructure for the Future

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Abstract:
More than 20 years after the Brundtland Report we are still grappling with what it means to be 'sustainable.' Historically, many of New Zealand's industrial operators have remained silent on how sustainable development applies to their business. New Zealand Steel (NZ Steel) is one such company that has only in recent years acknowledged its efforts towards achieving a cleaner and more efficient production process in the context of sustainability.

Well before the debate became mainstream, NZ Steel sought to advance the sustainability of its unique steelmaking process through progressive engineering and good operational practices. Environmentally efficient practices are incorporated across all levels at NZ Steel, from existing operations to large scale capital projects. Some projects implemented have required substantial capital investment, while other smaller initiatives have involved the implementation of management systems to direct activities and behaviour. Compared to older mills like NZ Steel's Glenbrook Mill, more modern and efficient integrated steel mills may require less investment to improve their sustainability. Directly and indirectly, these initiatives have contributed to NZ Steel remaining internationally competitive and financially viable, whilst maintaining a significant contribution to New Zealand's economy.

This paper touches on the concept of sustainability within the wider steelmaking industry and elaborates on the successes and struggles that NZ Steel faces in working towards a more sustainable steelmaking business.

AUTHOR: **Leonard McSaveney** (FIPENZ, B.E, Dip. Bus.)

Presenter: **Len McSaveney**

Title: **Towards More Sustainable Concrete**

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Abstract:
Cement production is a capital intensive business, manufacturing a product that has to meet stringent New Zealand and International Standards. The material is traded between countries and is used in applications regulated by the New Zealand Building Code. Any changes to reduce its embodied energy and its carbon footprint must therefore be well tested and discussed with all affected parties before those changes can be made. Change, when it does occur, tends to be incremental but with transformational change as new technologies are proven and as funds are available.

Fletcher Building Ltd has a commitment to provide high quality building products to the New Zealand building industry and to do so safely, with the least possible impact on our environment. The first steps towards more efficient cement production were taken in the 1960's with the primary aims of to ensuring quality and reducing operating costs. Following that consolidation phase, the focus was on energy efficiency and then post-Kyoto, has been on a progressive reduction in greenhouse gas emissions. The current focus is on recycling and the conservation of resources, without losing the gains in energy efficiency and reductions in carbon dioxide emissions.

With cement produced as efficiently as possible, the Concrete Industry and Design Professionals are able to turn their resources to ensuring that the country's buildings and infrastructure, measured over their lifetime, have the least possible impact on the environment. The industries may be seen by some as slow to change, but they do listen to public opinion and they do react.

AUTHOR: Professor Ali Memon

Co-author: Nicholas Kirk

Presenter: Nick Kirk

Title: Sustainable Governance of Marine Fisheries: A Socio-Ecological Embeddedness Perspective

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Abstract:

The first objective in this paper is to propose socio-ecological embeddedness (SEE) as a normative analytical construct to interrogate sustainable governance of marine fisheries. The concept of embeddedness is underpinned by the notion of socio-economic and bio-physical systematic interdependencies. The second objective is to undertake a preliminary assessment of embeddedness of New Zealand's commercial, Maori and recreational fisheries. Our analysis demonstrates that a significant outcome of recent (post-1984) fishery reforms is unequally re-defined property rights. Consequently, the socio-ecological embeddedness of New Zealand fisheries is uneven and asymmetrical between and within different fisheries and across multiple spatial scales (globally to locally). The unequally defined property rights have generated continued social conflict including concerns about the ecological health of fisheries.

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Title: **From the Linear to Cyclic Approach for Sustainable Waste Management in Malaysian City**

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Abstract:
Cities in Malaysia are experiencing rapid changes and more resources have been consumed for its population and economic activities. This resulted to significant increase of wastes generation from cities and its activities. The solid waste generation in Malaysian cities increased from 16,200 metric ton per day in 2001 to 19,100 metric ton in 2005 or an average of 0.8 kilogram per capita per day. It is estimated that solid waste generation will reach 30,000 metric ton per day in 2020. Managing waste generated by cities is a challenge in Malaysia. Since independence in 1957, waste has been managed through the linear approach which focuses on disposals to landfill. This linear approach creates difficulties and resulted to negative impact on the environment and human health. Moreover with the limitation of ecosystems carrying capacity it will have difficulty to accept more wastes. Being aware of these problems cities in Malaysia have embarked on many programs for sustainable waste management. The transition for sustainability focuses on waste recovery which includes recycling, reuse and reduces approaches. The transition process was strengthened when the Solid Waste and Public Cleansing Management Act 2007 was enacted. This act is the ultimate commitment by the government to manage waste in a sustainable manner with emphasize on waste separation and waste recovery at source. The Act was steered by the National Solid Waste Management Policy and The National Strategic Plan for Solid Waste Management. However to achieve sustainability a framework for transition is needed and must include a cyclic systems that promote waste minimization, waste recovery, waste exchange and support industry. The framework will ensure smooth transition from linear to cyclic approach where the ecosystem could maintain its carrying capacity. With this framework in place sustainable waste management in Malaysian cities will be accomplish in the future.

AUTHOR: **Muaviyath Mohamed** (BSME, MSc)

Co-Authors: **Assoc. Prof. Susan Krumdieck**
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Presenter: **Susan Krumdieck**

Title: **Sustainable Renewable Electricity for Small Islands: A Methodology for Essential Load Matching**

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Abstract:
Renewable energy integration into diesel generation systems for remote island communities is a rapidly growing energy engineering field. Fuel supply issues are becoming more common and the disruption, instability and panic caused by fuel shortages results in inefficient and unreliable power supplies for remote island communities. This paper explains an energy engineering approach for providing renewable energy development, supply security, cost and sustainability objectives. The approach involves adapting proven energy engineering techniques including energy auditing, energy system modelling with basic cost analysis and demand side management. The novel aspect of this research is development of critical load engineering in the system design, and informing this with assessment of essentiality of energy services during the audit phase. This approach is motivated by experiences with previous fuel shortages and long term sustainability policy drivers. The methodology uses the most essential electric loads as the requirement for sizing the renewable energy capacity in the hybrid system. This approach is revolutionary as communication with the customers about availability and the need to shed non-essential loads both helps to meet cost and security requirements, and helps to reduce panic and uncertainty when fuel supply issues arise.

AUTHOR: **Nurul Sakina Mokhtar Azizi** (PhD Candidate)

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Title: **Risks associated in implementation of green buildings**

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Abstract:
The whole process of implementing Green Buildings is subject to risks. It is important for decision makers to fully understand the risks involved in Green Building implementation. This paper reviewed more than 20 past research studies on the risks involved in the growth of Green Buildings. The significant risks have been clearly outlined and discussed in three stages of a project i.e design stage, construction stage and maintenance & operation stage. The decision makers in Green Building would have better understanding about the risks involved since they have been arranged according to the stages. The drivers of implementing Green Buildings are also listed and discussed in order to understand what the main drivers are. The three drivers are identified i.e (i) the implementation of new government policies that will help to promote or perhaps mandate eco-friendly features; (ii) Stakeholders perceive that Green Buildings will give higher profit in return and increasing awareness that green buildings tend to be more economical to operate; and (iii) the increase in level of awareness has been due to multiple researches on performance of green building

AUTHOR: **Mr Trivess Moore** (PhD Candidate / BSC (Env(Hons))

Co-Authors: Dr John Morrissey
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Presenter: John Morrissey

Title: **Cost benefit pathways to zero emission housing: Implications for household cash-flows in Melbourne**

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Abstract:
Sustainability literature highlights the potential of the residential sector to contribute to significant greenhouse gas emissions reductions. In this context, recent housing policies, not only in Australia but internationally, have addressed the implementation of minimum energy efficient housing standards. Recent UK, European and USA policy articulates a goal of zero emission housing by 2020. In Australia, while research has indicated that the introduction of the '5 stars' mandatory building envelope performance standard has resulted in a 20% increase in energy efficiency over pre 5 star homes, housing energy efficiency remains a contested policy area. The costs and benefits of more energy efficient housing are frequently argued in terms of a trade off between sustainability and affordability, and debate is focused particularly on upfront capital costs. There is a lack of clear cost benefit information on the impact of higher energy efficiency standards, and similarly on the impacts of integrating renewable energy strategies with energy efficiency strategies. Furthermore, actual impacts at the household cash-flow level have not been studied. This research therefore investigates the lifetime economic and environmental costs and benefits of improved sustainable housing options, including renewable energy options. Analysis focuses on four scenarios of improved housing performance for current and typical housing types in Melbourne, Australia. Research outputs seek to inform current debates surrounding low-emissions housing options by providing a case-book of evidence on household budget level impacts, in terms of monthly cash flows, of improved housing performance options.

AUTHOR: John Morrissey (PhD, BSc)

Co-Authors: Dr Usha Iyer-Raniga
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Dr Anthony Mills

Presenter: John Morrissey

Title: Proposal of a tiered conceptual framework for sustainable design and planning of large-scale development projects in the metropolitan context

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Abstract:

The overwhelming threat posed by climate change means that increasingly, emphasis is being placed on the need to integrate sustainability considerations into all areas of policy making, planning and development. Actors in the built environment are progressively considering environmental and social issues alongside functional and economic aspects of development projects. However, to date in Australia and internationally, there have been few practical examples of integrated applications of sustainability principles in the built environment across design, planning, construction, operation and de-construction phases. Notable initiatives have tended to be narrow in scope, focusing on either mitigation or adaptation strategies. Integrated considerations of impacts from component and building scales to city and regional scales and across physical and socio-economic dimensions are urgently needed, particularly for long-life major infrastructure projects. This paper proposes a conceptual framework based on the principal that early intervention is the most cost-effective and efficient means of implementing effective strategies for mitigation and adaptation. A Strategic Environmental Assessment (SEA) approach is forwarded as an umbrella analytical framework, assembled from analytical methods which are strategically 'tiered' to inform different stages of the planning and decision-making process. Techniques such as Ecological footprint, Life cycle costing and Risk analysis may be applied to integrate sustainable design, construction and planning considerations which address both mitigation and adaptation dimensions, results of each analysis ultimately being collated into the overall SEA. This integrated conceptual framework for sustainable, resilient and cost-effective infrastructure development will in practice be applied to assess selected case-studies of major development projects in Australia, focusing on the area of stadium development. Practically applied and timed accordingly, the framework would allow assessments to be targeted towards appropriate decision making levels and enable better decision-making and more efficient resource allocation for major infrastructure development projects.

AUTHOR: **Mr Ibrahim Mosly** (MEng)

Co-Authors: **Dr Guomin Zhang** (PhD)

Presenter: **Mr Ibrahim Mosly**

Title: **Study On Risk Management For The Implementation Of Energy Efficient And Renewable Technologies In Green Office Buildings**

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Abstract:
Sustainability is becoming an important subject these days in many countries around the world. This is mainly due to increasing governmental and public awareness about reducing the impacts of climate change on our environment. Green buildings are able to reduce greenhouse gas emissions and consumption of natural resources. Reducing either water or energy consumption is achieved in green buildings with the aid of certain types of advanced technologies. This is done in order to help these buildings become more environmentally friendly. Unfortunately, these technologies are relatively new and may present a number of risks during various phases of their lifecycles, affecting different project stakeholders. This paper will focus on the risks of energy efficient and renewable technologies (EERTs), which are mainly implemented in green office buildings. These risks are divided into four categories: heating, ventilating and air conditioning (HVAC), lighting, solar, and wind. It will present a comprehensive review of a number of risks pertaining to the application of EERTs. Furthermore, it will emphasize the need to create a risk management framework for EERTs implemented in green office buildings due to the current lack of research carried out to investigate and treat these potential risks.

Keywords:
Risk; Energy efficient technology; Energy renewable technology; Green office buildings

AUTHOR: Dr Gavin M Mudd

Presenter: Gavin Mudd

Title: The "Limits to Growth" and 'Finite' Mineral Resources: Re-visiting the Assumptions and Drinking From That Half-Capacity Glass

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Abstract:
The famous 1972 study "Limits to Growth" (LtG) created global controversy about its dire assessment of the potential future of humanity in the 21st century – eg. global population crash, rampant pollution, and running out of major non-renewable resources. Amongst some of the most fervent critics of LtG (after economic rationalists) were the mining industry, who argued that mineral resources are easily recyclable, new technology can increase known resources, price drives supply-demand balances, as well as exploration continuing to find new mineral deposits. This paper will re-visit the fundamental assumptions in the LtG study, comparing them in detail to the mega-trends in the global mining industry over the past century – trends such as declining ore grades, increasing tailings and mine waste rock, more refractory ores, deeper and/or larger mines, etc. Overall, the paper points to strong evidence for both points of view regarding non-renewable mineral resources: in one corner is the 'glass half-full' (industry) crew who look back and always remain optimistic about the future; while in an opposing corner is the 'glass half-empty' (LtG) crew who think about the future and believe the past justifies pessimism. Given the massive global scale of the modern mining industry, a detailed analysis of the assumptions regarding mineral resources in the LtG study is long overdue. This paper therefore provides a unique and thorough assessment of the primal factors governing the sustainability of mineral resources, pointing to significant limits to mining sometime this century – although the glass remains at half-capacity, a pessimist might argue that optimism is proving harder to maintain.

AUTHOR: **Colin O'Byrne** (MLArch)

Co-Author: **Associate Professor Penny Allan**

Presenter: **Colin O'Byrne**

Title: **Urban Form As A Reflection Of Governance Practices**

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Abstract:
The United Nations State of the World Population 2007 argues there is an increasing need and desire to improve the governance and form of cities because of their direct influence on living standards and global sustainability (Martine, 2007). While the UN report identifies some direct relationships between governance and the physical form of cities, little work has been done directly examining the cause and effect relationship between these two areas. As the fields of urban governance and urban design have a common interest in improving the way cities are developed and managed, it is important to articulate the relationships between the two fields of research. Through a critical review of related literature, this paper identifies parallels between urban governance and urban form. These preliminary findings offer insight into how different governance approaches may affect urban environments.

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Presenter: Joshua Olorunkiya

Title: Global Thinking-Local Action: Adopting the Low Impact Design (LID) Technologies in Urban Stormwater Management

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Abstract:
Economic development is conceived as the successful transformation of the structures of the economy which is reflected in increased urbanization to cope with the escalating population growth. The rapid expansions of the urban landscape as a result of increase urbanization have brought about rapid alteration in the hydrological cycle resulting in increases in runoff volume; peak flow rates/flooding and water quality impacts. The conventional stormwater management systems that were designed to remove runoff via piped conveyance systems and end of pipe treatment are no longer sustainable to deal with larger and more intense storm events and the associated pollution.

The adoption of the Low Impact Design (LID) technologies is considered a more sustainable approach to stormwater management. LID encompasses the use of structural devices (engineered systems) and non-structural devices (vegetated, natural systems) to maintain or restore the natural hydrologic functions on a site with the goal of reducing the impact of development for overall eco-system sustainability. Economic and environmental benefits of LID technologies are well documented through demonstration projects undertaken in the USA, Canada, Australia and the United Kingdom. Unfortunately, this innovative approach in stormwater management is yet to be fully adopted in new site developments in New Zealand. Hence, embracing the principles of global thinking-local action in the adoption of LID for urban stormwater management is the key to minimizing the urban footprint for the ecosystem sustainability.

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Title: Risk as a Fundamental Barrier to Adoption of Low Impact Design Technologies

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Abstract:
Urbanization has resulted in a rapid transformation of the urban landscape resulting in an increased stormwater runoff and the subsequent degradation of waterways. The conventional stormwater management systems designed for peak flow management and end of the pipe treatment (e.g. detention pond and retention basins) are no longer sustainable. Hence, the needs for a paradigm shift towards the adoption of Low Impact Design (LID) technologies that uses distributed controls approaches throughout the landscape to manage frequently occurring storm events. LID encompasses the use of structural devices (engineered systems) and non-structural approaches land use planning to maintain or restore the natural hydrologic functions on a site with the goal of minimizing the impact from urban stormwater runoff. Of particular concern are the rate and volume of stormwater runoff, the pollutants carried in the runoff, and recharge of water into the ground. LID has been proven to reduce development and infrastructure costs, minimize operations and maintenance costs, and improve the marketability of projects. However, the adoption of LID technology by stakeholders has been discouraging due to perception of risk about the failure of LID devices. To substantiate this as part of an ongoing research study, interviews with stakeholders were conducted to ascertain the level of perception of risk, factors influencing perception of risk and its impacts on adoption of LID technologies for stormwater management. The findings from this study shows a high level of awareness about LID technologies among the stakeholders, but the slow rate of adoption was associated with perception of risk, high cost of adoption among others factors are presented in this paper.

AUTHOR: **Matthew Paetz** (BPlan (Hons), BA)

Presenter: **Matthew Paetz**

Title: **Sustainable Suburbia – Oxymoron or Realistic Goal?**

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Abstract:
In 2009, the New Zealand Government established an Urban Technical Advisory Group to review current approaches to urban planning in New Zealand. One approach subject to the review is the widespread use of metropolitan urban limits (MULs). Conventional urban planning theory and practice argues that the use of MULs promotes sustainable forms of development by limiting urban sprawl and its associated encroachment into rural land and sensitive ecological areas. It also allows for intensification of urban form, leading to more viable public transport, mixed-use communities and less reliance on private automobile transport. An alternative view is that the use of MULs generate negative socio-economic consequences, such as inflating land and property prices in cities. This may make the goal of intensification within the existing urban form, the very raison d'être of MULs, difficult to achieve. This may then lead to a stalemate where development does not (or cannot) occur, and ultimately results in relaxation of the MUL. Critics of the use of MULs also argue that MUL-driven growth management approaches do not sufficiently recognise the multi-nodal nature of modern cities, with its dispersal of employment centres across a metropolitan region. These critics therefore argue that people living on the edge of the city do not necessarily face long commutes into the CBD for work, as many will work in regional centres near to where they live on the edge. Alternatively, they may even work from home.

This paper challenges such dualistic notions, critiquing both views. It explores alternatives to dogmatically restricted approaches such as unwavering application of MULs, or its conventional alternative "SLUDGEs" (Sprawl Led Urban Development Growth Environments), and proposes new alternatives such as sustainability-led suburban and ex-urban development to complement rather than compete with compact city models. Case studies of sustainability–led suburban and ex-urban developments are outlined.

AUTHOR: **Annie R. Pearce** (Ph.D., LEED AP)

Presenter: Annie Pearce

Title: **Strategic Entry Points for Sustainability in University Construction and Engineering Curricula**

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Abstract:
As colleges and universities seek to evolve their curricula and programs to respond to growing demand for sustainability, the challenge is to find ways to increase the sustainability-related knowledge and skills of students in the context of an already full palette of educational requirements. The most common tactic, development of new elective courses, not only increases teaching loads and competes with existing courses in the curriculum, but it also isolates the concept of sustainability pedagogically and increases the perception that it is an optional specialty rather than an essential concept for all graduates. How can students most effectively learn the sustainability skills and information they need to know to be successful in today's industry? Where are the most strategic entry points in existing curricula to introduce these concepts? This paper presents an overview of six strategic entry points for sustainability in a typical construction- or engineering-oriented curriculum. It compares the pedagogical costs and benefits of each approach and shares lessons learned from experiences at two leading public American universities: Georgia Institute of Technology and Virginia Polytechnic Institute. The paper discusses opportunities in terms of three distinct perspectives on the pedagogy of sustainability: Stealthy Sustainability, Flagrant Sustainability, and a hybrid approach that combines the two over time as part of a strategy of diffusion and routinization of this innovation within existing curricula. The paper concludes with a discussion of considerations that should be taken into account when evaluating the potential for sustainability in new educational contexts.

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Co-Authors: **Kristen Sanford Bernhardt,** Ph.D.
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Presenter: **Annie Pearce**

Title: **Sustainability and Capital Projects: Modeling the Emergent Property of Total Cost of Ownership**

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Abstract:
Investment in sustainable building technologies and strategies holds promise for significant lifecycle cost savings over the operational phase of a facility's lifecycle and offers a way to more effectively meet facility needs within the social and economic constraints faced by public sector organizations. Studies suggest that building green need not always cost more initially, particularly if an integrated planning, design, and construction approach is taken; however, planners have few ways of accurately estimating the first costs of a green project during the early concept development stages, much less potential lifecycle cost impacts of sustainability. How can total cost of these facilities accurately be predicted during early planning stages when critical go-no go decisions are being made? This paper describes a model of the Total Cost of Ownership (TCO) of green facilities that can be applied at the earliest stages of concept development. An agent-based modeling (ABM) approach captures both the social and engineering systems that characterize a facility's lifecycle. During facility development, the interactions between the facility's owner, designer, and builder determine its technical and functional characteristics as well as its ultimate capital cost. Throughout the facility's occupancy, users and managers significantly influence performance and service life as well as lifecycle cost. ABM permits evaluating the impact of the institutional and industry environment on facility design and lifecycle performance while also capturing the cost impacts of tightly coupled facility systems that characterize green design. This modeling strategy explores how institutional policies and industry norms impact the behaviors of key agents – owner, designer, builder, user, and manager – involved in a facility's lifecycle and the resultant TCO. This strategy will answer the questions of how best to allocate scarce additional resources among all projects in a portfolio while enhancing sustainability in a way that ensures ongoing organizational functionality and support.

AUTHOR: **Annie R. Pearce** (Ph.D., LEED AP)

Presenter: Annie Pearce

Title: **Costing Sustainable Capital Projects: The Human Factor**

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Abstract:
Despite increased motivation to improve the sustainability of capital projects in the United States and beyond, stakeholder perceptions regarding the initial cost of these projects remain a significant barrier. Studies of the actual first costs associated with green projects have found the premium compared to conventional projects to be surprisingly small (2-3% of installed cost for the lowest levels of LEED certification), but contractor perceptions of the likely cost margin remain much higher, in the 10-15% range. Tactics such as integrated design are touted in the popular literature as a solution to the first cost barrier, but this focus on design-based solutions overlooks the underlying drivers of cost premiums for green strategies and fails to acknowledge the non-linear behavior of construction pricing. Until the process and drivers of contractor costing for green projects are better understood, overcoming the first cost barrier in a transformative way is unlikely. How do constructors and their associated supply chain establish the cost of green projects and systems, and what can it tell us about how policy and the project delivery process/ environment should be changed to reduce this key barrier to sustainability?

This paper explores how contractors, subcontractors, and their supply chains approach the task of work breakdown and costing for green vs. conventional projects, at various stages of the project delivery process. The primary aim of the research is to identify key leverage points in the process where relevant data can be introduced and actions taken to influence cost. The outcomes of the research will enable project stakeholders to obtain a better understanding of what influences the cost margin associated with green projects, thereby taking the first step toward controlling project cost for competitive advantage in the market and increasing the likelihood of adoption of sustainable technologies and strategies in capital projects.

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Co-Authors: **Paul S.A. Chambers** (BSc, GradDipEmergMgt, MA.)

Presenter: **Robert Perry and Paul Chambers**

Title: **Carbon Now And Carbon Futures – A Systems And Performance Based Approach To Reducing Greenhouse Gas Emissions In The Auckland Region.**

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Abstract:

The Auckland Regional Council (ARC) has led a consortium of all Auckland councils and key stakeholders to develop an integrated regional policy response to address critical climate change-related issues affecting the Auckland region's resilience and sustainable development.The development of climate mitigation policy has been underpinned by two separate but complementary initiatives – known as Carbon Now and Carbon Futures. Carbon Now is a performance - and systems-based management framework for measuring, monitoring and reporting greenhouse gas (GHG) emissions reductions against prescribed targets. Carbon Futures refers to a back-casting and visioning study which sought to (i) develop long-term (year 2040) emissions projections, and (ii) to evaluate a suite of interventions to reduce emissions.The two initiatives were developed in five stages. Stage one focused on the development of the Carbon Now framework and guidelines to provide a consistent methodology for the development of a detailed regional emissions inventory (Stage four). An initial estimation of Auckland regional GHG emissions was undertaken in stage two based on existing data to form a 2006 base year and "business as usual" projections to 2040. In stage three a suite of potential GHG mitigation options were identified and evaluated to deliver GHG reductions and broader co-benefits for Auckland region. In stage five a series of modified "business as usual" projection have been evaluated based on a series of scenarios and underpinning assumptions.

In stage two it was estimated that Auckland's regional emissions have risen by 17.7% between 2001 and 2008, compared to a 26% increase rise in national emissions since 1990. It was predicted that by 2040, regional emissions will increase by 87.3% relative to 2001 levels. The Auckland regional footprint equated to 10,040,084 tonnes carbon-dioxide equivalent (CO_2e) or 7.02 TCO_2e per capita in 2009. Revised emissions projections (based on "business as usual") as undertaken using the Carbon Now framework in stage four indicate a 4% increase by 2015, a 12% increase by 2025 and a 33% increase by 2040.

AUTHOR: **Felicity Powell** (PhD)

Co-Authors: Dr Abigail Harding

Presenter: Felicity Powell

Title: **The renaissance of inner city living and its implications for infrastructure: A Wellington case study**

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Abstract:

One anticipated result of an increase in petrol prices is that the number of people living in inner cities will increase, thus reducing residents' need to travel to places of employment, entertainment and retailing. In various ways, local authorities in New Zealand are already encouraging and enabling more people to live in city centres. As more people move into the centre of cities, it is increasingly important to understand the changes taking place. Using two case study areas in central Wellington, the aim of this paper is to identify the transformations that have occurred, evidencing that inner city living is emerging as an important feature of contemporary society. The implications of these changes on the infrastructure required by an expanding residential population are also discussed.

Empirical discussion is based on two separate forms of information and analysis as follows:

- The global renaissance of inner city living: Evidence is presented of the revival of inner city living. To put this into context, some of the main changes to inner city Wellington that have occurred from early European settlement to the present day are investigated.
- Contemporary transformations of inner city areas: This part of the research uses property ratings data from 1994-2009 to document the transformations occurring to property functions (e.g. retailing, healthcare, warehousing, residential) in two parts of central Wellington: Te Aro and Thorndon.

The empirical evidence suggests that recent transformations are not uniform, are location specific and have occurred rapidly. If economic and social processes are aligned with local and national state policies, then further swift transformations are possible in the future.

AUTHOR: **Caleb Clarke** (BE(Env))

Co-Authors: Lucy Preston
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Presenter: Caleb Clarke

Title: **Getting on track for sustainability in education: Observations from the Unitec Environmental Sustainability Programme**

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Abstract:
New Zealand is facing the requirement to adapt to global forces such as population growth and climate change. Across the country plans are being made in order to respond to the changes and the challenges that they carry. The long term aim is based on leading a high quality of life while maintaining a healthy environment for future generations. Education for sustainable development strives to embed sustainability in everyday lives.

UNITEC New Zealand has embarked on implementation of a comprehensive Environmental Sustainability Strategy (ESS). They plan to act as advocates of practical sustainability across four key strategic areas within the institute – Teaching, Research, Advanced Practise and Campus (T.R.A.C.). "Teaching" focuses on the need to incorporate sustainability into the curriculum and use existing staff members and talent to offer a sustainability focus in every degree. "Research" is based on developing Unitec's research ability relating to sustainable technologies from design to build with a transdisciplinary focus. "(Advanced Practice) Advocacy" aims to provide Leadership and make Unitec a centre of public information for community, staff member and student sustainability education. It also focuses on collaboration links with other best practice organisations locally, nationally and internationally. "Campus Management" intends to manage the Unitec campus to become a living example of sustainable best practice, in all aspects of the organisation's function. This paper explores the journey that Unitec is taking towards becoming a sustainable tertiary education institute.

AUTHOR: **Paul Quinlivan** (BE (Chem) (Hons), MIPENZ)

Co-Authors: Shelley Quinlivan

Presenter: Paul Quinlivan

Title: **Learning Today: Sustaining Tomorrow. Authentic collaboration between the education and business communities can produce a deeper understanding of sustainability**

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Abstract:
The New Zealand Curriculum, revised in 2007 for implementation in 2010, makes extensive reference to a holistic view of sustainability. It is accepted that most education professionals (including teachers) understand environmental sustainability. However it was suspected that the concepts of social sustainability and economic sustainability were less well understood by education professionals, and as such their understanding would not be holistic. In 2008 the New Zealand arm of a global professional consulting business recognised that its employees understood and practised sustainability in their everyday lives so what better than to work with the education community to develop a teaching and learning resource to bridge this perceived gap in understanding. In 2008, 2009 and 2010, the business selected and then collaborated with an Auckland primary school and an educational consultant to produce such a resource. This journey has been analysed through the lens of qualitative phenomenological research (the evidential examination of an experience as it actually occurred). The research confirms that most education professionals need a deeper understanding of the holistic concept of sustainability in order to teach the concept effectively and that a professionally sound teaching and learning resource on this subject is valued by teachers. The research also found that authentic collaboration between the education and business communities can produce both a professionally sound resource and a deeper understanding of sustainability. It also found that professional development opportunities for all collaborators can occur during such a process.

AUTHOR: **Stephen Reay** (PhD)

Co-Authors: Andrew Withell
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Presenter: Steve Reay

Title: **How To Effectively Engage Students' With Environmentally Sustainable Product Design?**

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Abstract:
It has become increasingly evident that the impacts of human development and production/consumption over the last half of the twentieth century and into the twenty-first century are unsustainable in the long term. The response to this is an increased focus on identifying opportunities to support and enhance sustainability. This transition not only presents a huge challenge for product designers but also provides opportunity for designers to reframe their practices and processes. It is therefore imperative that the teaching of sustainable design is embedded deeply into the curriculum of product design programmes. Responding to the need for a focus on sustainability in higher education, many programmes have developed projects centred on design for social responsibility. Furthermore, despite the plethora of sustainable design frameworks attempting to provide solutions to the world's ecological crisis, many designers oversimplify such systems in order to attain suitable design outcomes. These may result in superficial design responses when it comes to issues of sustainability. Due to the complex nature of ecology and ecosystems, developing student projects that go beyond "eco-design" will help them to better cope with the complexity of the relationships between the environment, society and the economy

We propose that a new approach is required to engage students more deeply in environmentally sustainable product design. This approach will assist students to develop greater ecological literacy and develop new modes of design process thinking that is required to help negotiate future environmental and social challenges. In effect, the proposed approach reflects the need for collaboration between scientists (ecologists) and designers to build new capacity in this area.

AUTHOR: Stephen Reay (PhD)

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Title: Design For Biodiversity: A New Approach For Ecologically Sustainable Product Design?

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Abstract:

McDonough and Braungart proposed the "Cradle to Cradle" design framework to provide solutions to the world's current ecological crisis. This approach, based on examples from nature, ensures that human activities can have a positive ecological footprint, capable of replenishing and regenerating natural systems, as well guaranteeing that we are able to develop a world that is culturally and ecologically diverse. In their framework they describe the notion of biological nutrients, where industrial waste (non toxic & biodegradable) may be used as a beneficial nutrient for ecological systems, eliminating the need for efficiency, as "waste is good". Consequently, Cradle to Cradle industrial systems will benefit the environment.

A group of New Zealand scientists were asked to evaluate 'Cradle to Cradle' in an attempt to determine the potential of this approach for the sustainable design of products. Analysis of interview data indicated that sustainability is a complex and multifaceted concept, especially with regard to practical applications. In particular, understanding the input of biological nutrients into the environment was identified as being critically important. Furthermore, science can play an important in understanding the impacts of products, as well as how biological nutrient's may be best used in environmental systems. The insights gathered from these interviews were used to explore the potential for an alternative sustainable design approach, which builds upon McDonough and Braungart's concept of a biological nutrient, and aims to support the design of products that have a strong ecological foundation. Consequently, Design for Biodiversity is outlined as a potential approach for designing environmentally sustainable products. During the development of this approach, the relationship between science and design was explored to support the notion that ecosystems are the basis of human consumption and should be incorporated as an integral part of society to ensure the development of strong sustainability. The intent of this approach is to help to design ecologically beneficial products. It is relatively untested, and should be evaluated and revised during future design projects.

AUTHOR: Stacy Rendall (BE)

Co-Authors: Assoc. Professor Susan Krumdieck
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Presenter: Stacy Rendall

Title: Quantifying Transport Energy Resilience: Active Mode Accessibility

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Abstract:

A reduction in the energy intensity of private transport is necessary to mitigate the uncertainties of future oil supplies, given the impending peak in world conventional oil production. The built environment and transport infrastructure of an urban form will determine the extent to which low impact adaptations to these constraints are possible, and hence the resilience of residents to fuel price shocks and constraints.

This paper introduces the concept of Active Mode Accessibility, a method to characterise the underlying geographic form of an urban area and its transport networks. The active mode accessibility is defined as the proportion of activities that can be reached by active modes, given the population demographics of the study area. Greater active mode accessibility implies greater resilience to fuel price shocks and constraints. This paper introduces a spatial method for characterising the active mode accessibility within a selected study area, a GIS-based tool for applying the method, and presents two case studies. The active mode accessibility analysis is relevant to the redevelopment of existing areas and during the planning of new developments.

The central Christchurch case study gives an active mode accessibility of 100%, as there are a wide range of local facilities available for every activity. The Rolleston township case study gives a significantly lower active mode accessibility of 62%, due to a lack of local facilities. The high facility density of central Christchurch for all activities results in a high level of resilience to both fuel price shocks and constraints. The complete lack of local pre-school and secondary education facilities was found to drastically reduce the resilience of Rolleston. As both study areas are expected to significantly increase in population in the near future, these findings are valuable for future planning within the context of fuel constraints.

AUTHOR: **Ms Anna Robak**[1] PhD candidate

Co-authors: **Dr Henning Bjornlund** [2]

Presenter: **Anna Robak**

Title: **Trade-offs between public health and environmental protection in a potable water supply context: Drinking Water Standards New Zealand vs resource consent conditions**

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Abstract:
Water suppliers face significant financial pressure because of ageing infrastructure, increasing demand, and increasingly stringent legislative requirements. Their funds are generally insufficient to meet all of these requirements; it is therefore necessary to begin considering alternative approaches for providing safe, secure drinking water. One of the most important opportunities for achieving public health, environmental, and economic targets is a more collaborative approach involving 'soft' options. Water suppliers tend to select engineering options for compliance even when soft path options are available – partially because they lack the quantitative assessment to back up the softer options. If water suppliers quantitatively assessed and therefore understood the costs and benefits of their options, they could use this insight to pressure legislators to justify or amend standards and conditions, as well as to expand the range of permissible compliance options. In New York, over nine million people drink unfiltered water thanks to catchment protection initiatives. Filtration plants would have incurred significant costs and produced significant volumes of sludge that would need to be disposed of in an environmentally responsible manner, which would incur further costs. The DWSNZ require filtration plants for any surface water, thereby producing sludge and requiring discharge consents. To comply with discharge consent conditions, water suppliers build costly sludge handling facilities that can use significant energy and chemicals. New York City has avoided all of these financial and environmental costs using a soft path approach. The Ministry of Health and regional councils should consider more collaborative approaches in New Zealand.

AUTHOR: Jesús Rosales Carreón MSc.

Co-Authors: Professor René Jorna
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Presenter: Jesús Rosales Carreón

Title: Sustainability: Seeing through the eyes of farmers.

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Abstract:
In The Netherlands, the agricultural sector is facing a major challenge, which is the transition towards a sustainable agriculture. The discussion thus far has been at a conceptual, macro level. A more deep approach to sustainability involves examining who is using this term, and how. For example, how does sustainability operate at the farm level? Hence, it is relevant to investigate the knowledge processes of the main actors in agriculture: farmers. For knowledge processes, we mean the processes that (individual) farmers undertake to understand the information they receive. These processes are divided in two domains, static domain, which deals with the way an individual structures knowledge; and dynamic domain, which deals with the thinking processes of an individual. Our study proposes to explore the two domains of knowledge held by farmers in The Netherlands. Individual structures of knowledge will be explored through cognitive mapping exercise. Thinking patterns will be explored through protocol analysis. Both the cognitive maps and the protocol analysis have to be analysed to reveal commonalities and differences among farmers. This manuscript contributes to research on knowledge of sustainability, which has barely penetrated discussion within the agricultural sector. It shows cognitive mapping and protocol analysis might be effective techniques for investigating the meaning of a subject like sustainable agriculture.

AUTHOR: **Bridget Rule** (BA, BE (Hons))

Co-Authors: Assoc. Professor Carol Boyle

Presenter: Bridget Rule

Title: Challenges For Sustainable Infrastructure Development In Small Island Developing States

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Abstract:
The ongoing viability of many small island developing states (SIDS) is under pressure from factors including climate change, sea level rise, and their usually high dependence on imported food, energy, and manufactured goods. Sustainable, resilient development is a necessity for SIDS if they are to ensure their ability to maintain and improve their populations' quality of life in the face of these challenges. Infrastructure that supports sustainability is therefore a key element to SIDS development, but SIDS have historically had major issues with infrastructure development, centring on economies of scale as they tend to have small, dispersed populations, combined with few natural resources and limited funds. Pinpointing exactly what can be done to improve SIDS' resilience through sustainable development requires first pinpointing their main sustainability and development issues in greater detail, and looking at salient characteristics country by country. Examining SIDS in this manner reveals that they have as many characteristics setting them apart from one another as they have in common. As such, while SIDS' present and historical development issues have common threads, their future opportunities and pathways to resilient, sustainable societies may be very different. In determining whether and how individual SIDS could become sustainable, the concept of urban metabolism may be useful through measuring SIDS' endemic ability to support their populations.

AUTHOR: Dr John Russell

Co-author: Mr Kevin Long

Presenter: John Russell

Title: Transitions to Sustainability - Are we confident about the IPCC climate change predictions for the future?

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Abstract:

In a quest for a "Transition to Sustainability" this paper, in the tradition of engineering enquiry, revisits the fundamental assumptions under-pinning the IPCC's pronouncements which concern the relationship between increasing anthropogenic greenhouse gases emitted to the atmosphere and corresponding projected average global temperature rises. The complexity of this issue, together with the stated uncertainty of outcomes, is re-examined in the light of natural phenomena (Pacific Decadal Oscillation, La Nina, Barycentre and reducing Sunspot activity) which now combined have commenced global cooling. This paper concludes that atmospheric carbon reduction measures are restrained until the trend in global warming or cooling is beyond doubt.

AUTHOR: Osamu Saito

Presenter: Osamu Saito

Title: Measuring Lifecycle Carbon Footprint Of A Golf Course And Greening In The Golf Industry

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Abstract:
Over 2,400 golf courses exist in Japan, most of which have been developed extensively in rural areas. Following the burst of the bubble economy, many existing golf courses had to take tough management decisions, and some were forced to close their business. Like in other industries, greening, i.e. embedding environmental considerations into industrial processes, products and services, is considered an effective management strategy essential for the survival of the golf industry. However, studies on lifecycle greenhouse gas carbon footprint (CF), which would serve as bases for planning effective environmental management, have not yet been conducted. In this study, lifecycle CF was measured by collecting data on golf course development specifications and by interviewing managers and greenkeepers. The lifecycle inventory consists of land preparation, course development and maintenance, equipments for turf maintenance, clubhouse construction and operation, and transportation used by golfers including the use of golf carts. We found that in Japan the lifecycle emissions of a typical golf course with 18 holes are 39,188 t-CO2 for 30 years, and carbon sequestration by the forest and planted trees in the course accounts for 16,944 t-CO2 during the same period. This means 43.2% emission is offset by carbon sequestration due to vegetation and the net CF is 22,244 t-CO2. Out of the total emission, course construction, clubhouse operation and transportation used by golfers are the three largest contributors. CO2 uptake in lawns comes at a carbon cost from fossil-fuel CO2 emitted during maintenance. Depending on the quantity used and the frequency of fertilisation, fertiliser-derived N2O emissions may overcompensate for the CO2 uptake. In addition, the management of the existing forest within a course influences positive or negative impact on this CO2 sink. The alternatives to minimize CO2 emission and maximize CO2 uptake were discussed towards the end of this study.

AUTHOR: **Judelyn Salon** (Graduate School Student)

Co-Authors: Dr Ermelinda G. Tobias

Presenter: Ermelinda Tobias

Title: **A Correlational Analysis of Collective Social Capital and Sustainable Development Program Outcome in Iligan City, Philippines**

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Abstract:
The study examines the elements of social capital that promote and those that impede collective action towards achieving positive sustainable development program outcome. Employing the quantitative correlational method of research and utilizing the landscape approach, 40 participants for each seven (7) communities in Iligan City, Philippines were surveyed. Inferential analysis used for this research includes logistic regression to determine the significant contribution of each level of the independent variable into the logistic model. The probabilities and subsequent odds ratios are the parameters used to quantify the relationships and conversely, the disparities between and among variables. Data revealed that development programs affect social capital and the difference of social capital determines the perceived success of development programs.

AUTHOR: **Kay Saville Smith** (MA, Hons)

Co-Authors: **Lois Easton** (MSc, Hons)

Presenter: **Lois Easton**

Title: **Market Transformation to Achieve Large Scale Uptake of Sustainable Residential Renovation in New Zealand**

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Abstract:
New Zealand's housing stock is acknowledged for its poor performance, particularly as relates to energy and water efficiency and indoor environment quality. The 1.4 million houses are mainly detached, timber framed houses with poor thermal efficiency and similar design across New Zealand's variable climate – from the moist warm north, to the cold dry south. Beacon Pathway, a research consortium of public and private stakeholders, has, over the past 4 years been researching approaches and developing tools and information aimed at increasing the uptake of sustainable renovation. Beacon developed the HomeSmart Renovations Project as a transformational programme to encourage effective retrofit and renovation take-up that would improve the performance of New Zealand homes. The programme includes: (a) undertaking case study sustainable renovations, monitoring and reporting on their effectiveness; (b) developing consumer and industry information about ways to improve the sustainability of houses; (c) working with the retrofit and renovation sector to increase their capability around assessment and implementation of sustainable renovation; (d) developing specific information on renovations targeted to individual homeowners based on the condition of their house; and (e) working with local government to improve plans, policies and processes to support and promote sustainable renovation.
This paper will present the research methods used to monitor and assess the effectiveness of the programme. This includes the direct monitoring of metered energy, water and temperatures in 200 homes, and the reporting of various performance indicators by a further 400 homes. The findings of the research processes will be presented.

AUTHOR: **Eion Scott** (BA, Dip Jour)

Co-Authors: **Jennifer Kerr**
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Presenters: **Eion Scott and Jennifer Kerr**

Title: **Resilient Communities: A new resource**

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Abstract:
Resilient Communities is a new topic added this year to the highly regarded, council supported Sustainable Living course, which has been running since 2001. The resilience topic aims to show how individuals and communities can adapt to meet the related challenges of civil emergencies in the short term and more fundamental changes to the climate and way of life in the longer term.

This paper outlines how Sustainable Living has broadened the focus of its adult education programmes, and why it has chosen community resilience as a new theme. It looks at where the topic fits in the overall strategy for Civil Defence awareness and community transition programmes. And it traces the development, testing and evaluation of the course's pilot workshops.

Finally, it discusses the market for sustainability education in New Zealand – who is the course targeting and will it help offset the barriers to course attendance (the latest being the cut in government funding for community education). Are new generations of New Zealanders more open to learning about sustainability when it includes a vision of a reinvented future?

AUTHOR: Sarah Sinclair[1] (MBA, BEng(Hons) CEng MICE)

Co-Authors: Louise Webster[2]
Dave Woods[3]

Presenter: Sarah Sinclair

Title: Rethinking Sustainable Infrastructure Using Innovation Tools.

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Abstract:
Too often, developing and implementing infrastructure relies on the lessons of the past – we build in our lessons learnt and rely on recent history as a marker of what the future will be like. So, we rely on the past for our review of economic, environmental and social drivers and their impact on infrastructure projects. For infrastructure owners, and infrastructure providers, our challenge is how to move away from "we've always done it like this" to bring divergent thinking into our projects to make them more future-facing.

North Shore City Council sees innovation as a major factor in building sustainable outcomes. As an infrastructure client, NSCC asked innovation consultant Ideas Accelerator to work with SKM, its Principal Consultant on a major wastewater infrastructure programme of work; to develop a way of making innovation part of Business As Usual.

This paper covers how NSCC, Ideas Accelerator and SKM's Sustainability Practitioner developed innovation tools to be used at key project stages to drive innovative, sustainable outcomes throughout infrastructure projects from feasibility studies through to construction. The paper will also focus on how sustainable outcomes were incorporated into the tools.

The paper covers the subsequent testing of the tools, lessons learnt, and outcomes when the tools were used on real infrastructure projects; using NSCC's quadruple bottom line to appraise outcomes.

AUTHOR: Narantuya Batmunkh (M.Eng)

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Presenter: Komsun Siripun

Title: Sustainable Use of Crushed Concrete Waste as A Road Base Material

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Abstract:
Crushed concrete waste is a by-product from building demolition and constitutes a principal component of municipal solid waste consisting of concrete, sand, brick, rock, metals and timber. Over 50% of this waste is commonly sent to land-filled sites, resulting in the impact on the limited capacity of land-filled sites. Nowadays, the sources of virgin natural aggregates are depleted by increases in demand of using a virgin material in building and infrastructure construction and maintenance facilities. This depletion leads to the utilisation of crushed concrete waste to replace natural aggregates in road and highway construction. Of key significance of this study is to present alternative materials for road and highway construction on the production of the proper guideline for road base by using crushed concrete waste. Sophisticated tests were conducted to investigate the mechanical responses of compacted crushed concrete subjected to applied loads simulated from traffic loads. Unconfined compressive strength, shear strength parameters and the resilient modulus of such material were determined. Our findings showed that crushed concrete waste is able to be utilised as a road base material. The results of this study will enhance increased use of crushed concrete waste in road and highway construction and will, therefore, alternatively reduce consumption and costs in manufacturing virgin aggregates.

AUTHOR: Jonathan Slason (PE)

Presenter: Jonathan Slason

Title: Unintended Consequences of Reduced Consumption

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Abstract:
This paper explores potential changes to the way government and citizens may be required to shift expectations of government responsibility if sizeable portions of society shift to methods of daily consumption and behaviour not captured by traditional Gross Domestic Production (GDP) calculations. The GDP measure depends on consumption, government spending, investment, imports versus exports – all reliant on transparent and traceable monetary system.

As increasing numbers of municipalities investigate ways to use local currencies, and/or support initiatives such as time-banks and barter based exchanges, this paper explores the impact that reduced cash flow could have on revenue tax collections and the associated monies used for government expenditures. These locally based means of trade and transactions can provide benefits captured by other indicators of education, progress and happiness, however they do reduce the amount of trade captured by traditional monetary measures.

As members of society look to become additionally self sufficient it might be possible to reduce wages and reduce consumption, therefore reducing the tax collection and revenues based on consumption. It is clear that efforts to reduce the daily reliance on a cash based society, previously captured in traditional GDP calculations, may have impacts much further than most involved in these efforts realise.

Governments large and small rely on GDP calculations for revenue comparisons, bonding capacity, and general government expenditure obligations. Reductions in monies collected by members of society could significantly impact the ability of government to provide the services many members of society consider necessary.

AUTHOR: **Tara J. Smith** BEnvEng (Hons)

Co-Authors: Dr Gavin M. Mudd

Presenter: Tara Smith

Title: **Shallow Groundwater Resources and Future Climate Change Impacts: A Comparison of the Ovens and Namoi Catchments, Eastern Australia**

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Abstract:
The Murray-Darling Basin (MDB) river system is a critical province and water resource for Eastern Australia. Over the past decade the MDB has been subject to a protracted and severe drought, as well undergoing major institutional, social and economic reforms. A lesser understood area of MDB water resource issues is the status of groundwater, especially with respect to trends in groundwater resources, groundwater-surface water issues and the longer term susceptibility of groundwater to climate variability and climate change. Following the cap on MDB surface water allocations in 1994, a major expansion of groundwater use was observed across many parts of the MDB, which has probably been further exacerbated by the current drought leading to lower groundwater recharge. This paper presents an overview of the current status of Murray-Darling Basin groundwater resource use and management, contrasts two case study sites in the Ovens and Namoi catchments of Victoria and New South Wales respectively, assesses the potential risks that climate variability and climate change present, and finally considers some long term solutions to ensure that the MDB continues on its transition to a more sustainable future.

AUTHOR: **Mr Aaron Tanner** (BA Hons, MSc)

Co-Authors: Dr Brian McIntosh
Dr David Widdowson

Presenter: Aaron Tanner

Title: **Adapting To Adopt Sustainability: Organisational Change In UK Water And Sewerage Companies**

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Abstract:
This paper reports on research employing the Five Capitals model of sustainability to identify and facilitate the exploitation of opportunities for improved incorporation of sustainability appraisal within the asset delivery practices of a major UK water and sewerage company (WaSC). The main aim of the paper is to identify and characterise the factors which influence the way in which sustainability appraisal changes are adapted and employed (adopted) by the WaSC concerned. The Five Capitals sustainability principles were applied as a questioning framework in a series of focus groups to create a shared comprehension of sustainability, whilst mapping the perspectives of the business unit as to the form and efficacy of current sustainability appraisal activities. Subsequently, attempts were made to deepen appraisal activities in areas perceived as poorly managed through the development of a set of sustainability Key Performance indicators (KPI). Finally, both processes were analysed to identify the factors which influenced sustainability appraisal change. The eventual adoption or rejection of the proposed KPIs were influenced by the (i) extent of their alignment to company leadership visions and policies; (ii) the extent to which relevant data and expertise already existed and could be easily utilised for KPI reporting, and; (iii) the extent to which business changes involved in KPI production, reporting and reviewing fit with existing divisions of responsibility and management between business units. The case-study of organisational sustainability adoption presented here illustrates factors that influence the ability of large water utilities to change. The results demonstrate that improved incorporation of sustainability will probably proceed incrementally and may require significant changes in organisational structure, expertise and vision.

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Title: Technology Windows in Sustainable Innovation Projects: Experiences with an Innovation Tool for Identifying Sustainable Application Domains

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Abstract:
Emerging technologies are potentially interesting for sustainable innovation in high-technology firms and for 'techno-starters'. This article provides an innovation tool for sustainable technology-oriented innovation, as there are hardly any of these kinds of methods available. The Technology Window tool helps to find valuable applications and helps to evaluate if the application fulfils sustainability criteria. The window is a symbolic visualization, in which each side represents a key dimension: the strengths of the technology, one or two constraints that apply to utilizing these strengths in a sustainable way, and the technological drivers (trends and developments). This paper describes eight empirical cases used for evaluation and validation of the innovation tool. The technology window has been applied in student projects and used as a workshop tool in a professional setting. In most cases the innovation tool successfully structured the front-end of technology-oriented innovation. It was most effective in cases where the strengths of the technology were not obvious and when a new application domain was needed. In these cases the method resulted in surprising and innovative ideas. The method proved to be valuable to structure the front-end of technology-oriented innovation in sustainable innovation projects and for sustainable emerging technologies.

AUTHOR: **Dr Maria Estela Varua** (PhD in Economics)

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Presenter: Anna Evangelista

Title: **(Un)sustainable Consumption in Australian Households: An Exploratory Study**

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Abstract:

Unsustainable consumption has been identified as one of the main causes of global environmental deterioration. Particular attention is paid to the role of household consumers and the consequences of their choices. A number of studies show that different socio-economic groups within a nation have diverse consumption profiles leading to different environmental impacts. Thus, policies or programs aimed at regulating unsustainable consumption or promoting sustainability at the household level should be based on a good understanding of the relationship between consumption and the characteristics of households.

The current study aims to assess the consumption or usage patterns of households in NSW, Australia with respect to two main groups of environmentally relevant services namely, energy (electricity and gas) and water. The micro-econometric analysis takes into account the effects of the following variables: household income, household size, age, educational level, main occupation, dwelling type, dwelling ownership and labour force status. The data come from the latest (2003-04) cross-sectional survey of the Australian Bureau of Statistics on household expenditures.

In addition to the empirical results, the paper also presents a review of approaches to model demand, previous empirical studies on the determinants of unsustainable consumption and relevant methodological issues. This study differs from most previous studies on the subject in that the analysis is at the household level and focuses on specific household characteristics as potential determinants of water and energy consumption.

AUTHOR: **Jeffrey Vickers** (BE (Hons))

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Presenter: **Jeff Vickers**

Title: **Design for Sustainable Development: A Framework for Sustainable Product Development and its Application to Earthmoving Equipment**

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Abstract:
Innovation to improve the eco-efficiency of products and services is often thought to take place at four levels: product improvement, product redesign, function innovation and system innovation. This paper presents a framework, Design for Sustainable Development (DfSD), to help organise action for product and service innovation within and between the lower three levels. At the highest level (function innovation), the graphical scenario-building technique Scenario Network Mapping is used to explore and chart possible future developments for the current market of the product or service. The scenarios take a long-term (20 year) perspective and are constructed through dialogue with key stakeholders. New product/service concepts can then be 'tested' against these scenarios for robustness (i.e., performance under multiple scenarios) and adaptability. Once a concept is selected, product and technology roadmaps are drawn up to plan the development of the product/service and the different social and environmental benchmarks that should be met generation-by-generation. At the lower levels (product improvement and product redesign), techniques such as life cycle assessment, eco-design and material blacklists are used to help optimise the current product/service offering and comply with relevant legislation. The framework is illustrated by a case study focusing on the use of wheeled loaders in the construction aggregates industry up to the year 2030.

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Co-authors: Dr Gavin M Mudd[1,#],
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Presenter: Zhehan Weng

TITLE: Projecting the Full Pollutant Cycle from Coal Utilization to 2200: Understanding the Global Environmental Implications

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Abstract:
The mining and consumption of coal has long been a primary factor in global energy supply. Australia, Canada and the United States of America (USA) are four crucial coal exporters and consumers worldwide. Their historical coal production trends, future coal production trends, mining methods, coal quality trends are critical in determining the capacity and feasibility of global continuous coal use toward 2050 and beyond to 2200. As a finite and exhaustible resource, coal has a logistical 'peak' regarding its limited reserves and increasing demand. In order to predict the magnitude and timeframe of the 'Peak' of these four countries, Hubbertarian peak models are developed with a range of available coal production data to establish future coal production forecasts. Pollutant emissions such as sulfur dioxide and particulates associated with coal mining and use in electricity generation are important environmental constraints, although they often receive less attention than greenhouse emissions. Given the availability of pollutant release data from Canada, Australia and the USA, we assess the pollutant intensities associated with coal mining and electricity generation, and combine this with Hubbert peak models to project potential future pollution loads from coal mining and use. Overall, this paper uses historical data to project the future production of coal in Australia, Canada and the USA and combines this pollution intensity to assess the environmental implications of continued coal use. The paper therefore addresses two central themes of sustainability – that of resource depletion and pollution loads, both of which require careful scrutiny in the face of climate change, public health and related issues.

AUTHOR: Professor Emeritus Arthur Williamson

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Presenter: Arthur Williamson

Title: Transitions In Transit: Future Options For Transport Energy In New Zealand

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Abstract:
Transport contributed 20.1% of New Zealand's GHG emissions in 2009. This, coupled with our current dependence on imported transport fuels provides a strong motivation to examine alternatives. In this paper we examine two conservative policy scenarios for the transition from internal combustion engine powered vehicles to electric vehicles, using transport data from an historic 10 year period. Electrification is an attractive option, but the transition to a largely electric car fleet is shown to be relatively slow.

An orderly transition from our existing vehicle fleet is demonstrated to require a consideration of liquid biofuels. The land footprint requirements for liquid and gaseous biofuel production, and of electrification, are revealed and their implications discussed.

It is concluded that biofuels will play an important role in moving toward a sustainable transport system, but that complimentary policy measures, including serious attention to transport patterns, will also need to be considered.

AUTHOR: Dr Rachel Wolfgramm

Presenter: Rachel Wolfgramm

Title: Creating leadership in transition to sustainability societies: Reflections from the Universitas 21 Sustainability Project

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Abstract:
In order to ensure 21st century relevance and progression, universities worldwide are developing innovative approaches to research and education for sustainability. Whilst it is an agenda that has been underway for many decades, in recent years, due to the escalation of sustainability related concerns worldwide, universities are repositioning themselves in renewed efforts to create leadership in transition to sustainable societies. As "living laboratories", they are spearheading a shift in principled driven intellectual and solutions based activities that exemplify their role as critic and conscience of society. (Cortese, Second Nature). Further to this, in seeking to advance lateral synergies across vertical specialisations, universities are proactively leading transdisciplinary research in private/public/community partnerships. Projects involve the convergeance of a range of specialisations. Such initiatives take current sustainability related challenges and create suitable institutional mechanisms that facilitiate collaborations across disciplinary boundaries and well beyond the confines of uiniversities. The overarching goal is to act as change agents by collaborating to develop new knowledge designed to facilitate better understanding of the issues at hand whilst simultaneously enhancing the capacity to generate sustainable solutions. These initiatives in universities around the world indicate a genuine desire to meet and address sustainability challenges of the 21st century. They highlight the role universities are playing in creating leadership in transition to sustainable societies.

AUTHOR: **Damian Young** (BE Env)

Co-Authors: **Jan Heijs** (BE)

Presenter: **Damian Young**

Title: **Can Catchment Management Can Be Delivered For The Auckland Super City Watersheds And Achieve Sustainability?**

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Abstract:
In Auckland, under existing governance, the Auckland Regional Council has been working to provide guidance on how to structure Integrated Catchment Management Plans and for preparation by local authorities. This results in, what should hopefully be, consistent outputs. However, this is not the case as institutional capacity, available budgets, community expectation and business practices, of the individual councils, are critical factors in the production of consistent planning outputs. It is not so much the calculations, designs or plans that are generated, but more the systems and technical tools that support them that are proving to be increasingly important. How then are we to build resilient societies?

The integration of information sets through GIS and documented management systems can allow multi-department/organisational collaborations to flourish. Under a "total watershed management approach" that includes infrastructure, such as roads, wastewater/water supply and multiple land uses, it is possible to combine visions and resources to achieve more sustainable results and outcomes.

Given we are on the verge of deconstructing to reconstruct a One Auckland Super City it is imperative the tools are available and the business processes well understood to take advantage of the expected benefits of amalgamation and build resilient societies. This paper investigates just what might be required in the One Auckland Scenario to achieve Integrated Catchment Management best practice and resilient infrastructure.

AUTHOR: Associate Professor Ahmad Zahedi

Presenter: Ahmad Zahedi

Title: Sustainable Electric Energy Supply By Decentralized Alternative Energy Technologies

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Abstract:
Energy is a fundamental component of human life with strong link to the living standard. It is important to understand that this important human life component is used in a sustainable way. Sustainable energy from production, consumption, and environmental point of view is research fields of many researchers around the world. The real question is how energy can be used in a sustainable way and how decentralized alternative sources can contribute to sustainability of energy.

Currently, fossil fuel, world-wide, and nuclear energy, in some countries are the main source of energy in both developed and developing nations. Using these sources, which extract fuels from finite earth resources, is associated with some environmental and social problems. We may have to make some major changes if we wish to address the challenges of sustainable energy. Many pressures are focused on electrical energy, in terms of its supply technologies and efficiencies. These concerns have often been expressed in demands for less use, greater end-use efficiencies, and more reliance on alternative sources such as solar photovoltaic (PV) energy, wind power and other sustainable power supplies.

The objective of this paper is to discuss some of the issues related to current energy structure from sustainability point of view and highlight the opportunities provided by decentralized renewable energy-based distributed generation technologies, for meeting the challenges of a sustainable power supply. A further objective is to present a sustainable energy model as well as the results of a computer simulation program developed for this purpose.